

# SUBJECT INDEX

## A

Absorption  
and function of enterocytes, 253-56

Absorptive function  
see Digestive and absorptive function

*Acanthosis nigricans*  
and insulin receptors and regulation, 367

Acetylcholine  
and the adrenergic-blockade in nucleotide transport, 612  
and gastric development, 199

Acetylcholinesterase activity  
and insulin-like growth factors, 458

Acetylsalicylic acid  
early clinical research, 12

Acid  
and gastric development, 200-4

Acid-base balance  
and the kidney, 156-57

Acidic amino acids  
and metabolic substrate transport, 111-12

Acidosis  
inotropic response of cardiac muscle to, 564

Acid phosphatase  
and ligand internalization, 385  
and lung surfactant recycling, 793

Acid secretion  
early research, 10-11

Acromegaly  
and IGF levels, 454

Actin-activated myosin ATPase activity  
and isometric force development, 640

Actin-bound nucleotide pools  
and metabolic blockers, 680

A-current channels  
involvement in rhythmic behavior, 18

Acyl-CoA  
and PDH enzyme complex, 650

Acyl CoA compounds  
and cardiac mitochondrial functioning, 656

Adenine  
metabolism of  
and purine salvage, 695-96

production of  
and purine nucleoside phosphorylase, 698

Adenine derivatives  
and kidney mitochondrial transport, 149

Adenine nucleotide catabolites  
and cellular damage, 732

Adenine nucleotide control  
of respiration, 709-15

Adenine nucleotide degradation  
and irreversible ischemic injury  
changes associated with, 737-43  
pathways of, 729-33

Adenine nucleotide-derived adenosine  
extracellular metabolism of  
single carrier for, 608

Adenine nucleotide translocase  
and cardiac mitochondrial function, 652-53  
as rate-limiting step, 655-57

Adenine nucleotide translocator  
and kidney mitochondrial transport, 154

Adenine nucleotide uptake  
and ATP-induced contraction, 606

Adenine nucleotides  
in heart and blood vessels, 665  
see also Myocardial nucleotide transport

Adenine phosphoribosyltransferase (APRT)  
in purine salvage, 695

Adenosine  
intracellular source of  
and cardiac mitochondrial function, 657-59  
metabolism of  
and purine salvage, 696  
and myocardial nucleotide transport, 605  
as potent cerebral vasodilator  
and cardiovascular nucleotide function, 672  
production of  
by S-adenosylhomocysteine (SAH) hydrolase, 698  
single carrier for  
and extracellular metabolism of, 608  
and vasodilation in cardiac muscle function, 666

Adenosine hypothesis  
in cardiovascular nucleotide functions, 666  
and oxygen deficient myocytes, 730

Adenosine kinase  
and purine salvage, 696

Adenosine transport  
inhibition of, 609

Adenosine uptake  
and endothelial nucleotide metabolism, 618-19

Adenylate cyclase  
hormone activation of  
and junctional physiology, 345  
hormone-stimulated  
insulin mediator to depress, 411  
inhibition of  
and cardiovascular nucleotide functions, 668  
and direct actions of GH, 494  
oocyte  
and gap junctions in development, 323

Adenylate kinase equilibrium  
and platelet nucleotide metabolism, 687

Adenylosuccinate synthetase  
and conversion of IMP  
to adenylosuccinate, 700  
and metabolism of IMP, 699-700

Adipocytes  
and elevation of AMP  
in insulin receptor kinase, 374  
insulin binding to, 358  
and receptor function, 470

Adipose cell glucose metabolism  
and IGF receptors, 425

Adipose conversion  
and effects of GH  
on cell differentiation, 490

Adipose tissue  
and glucose metabolism  
insulin-like effects of IGF, 449

ADO deaminase  
inhibition of  
hypoxia, 730

ADP  
as a potent activator of  
platelet response, 678

- and role in regulation
  - in energy metabolism, 631
- ADP-ATP translocase
  - kinetics of
    - and mitochondrial creatine kinase, 715
- ADP-generating reaction
  - and mitochondrial creatine kinase, 715
- ADP-generating system
  - hexokinase as, 710
- ADP-stimulated respiration
  - $K_i$  values for
    - figure, 716
- Adrenal corticosteroids
  - and prolactin
    - and insulin mediators, 416
- Adrenalectomy
  - and ontogeny of intestinal enzymes, 237
- Adrenergic/cholinergic-blockade
  - and ATP release
    - nucleotide transport, 612
- $\beta$ -adrenergic receptor
  - and desensitization of insulin receptor action, 375
- Affinity cross-linking techniques
  - and IGF receptors, 426
  - and insulin receptors, 365
- Aflatoxin B1
  - and gastrointestinal cell growth, 187
- Agriculture
  - contemporary
    - and annual rhythms, 65
- Alanine
  - and enterocyte development, 254
- Albers-Post model
  - and mechanistic studies
    - on sodium pump, 535
- Albumin
  - and gap junction functions, 287
- Alcohol
  - and gap junction functions, 294-95
- Aldehydes
  - and gap junction functions, 294
- Aliphatic monocarboxylic acids
  - see Carboxylic acids
- Alkaline phosphatase
  - activity
    - and insulin-like growth factors, 458
    - and ontogeny of intestinal enzymes, 235-39
- Alveolar epithelium
  - fluid lining of
    - and surfactants, 759-62
- Alveolar proteinosis
  - and tubular myelin
    - in ultrastructure of surfactants, 759
- Alveolar surfactant
  - see Ultrastructure of alveolar surfactant
- Alveolyn
  - and apolipoproteins of pulmonary surfactant, 781
- Amiloride
  - and binding to  $T_o$ 
    - in  $Na^+-H^+$  exchange, 554
  - derivatives
    - and Na-Ca exchange, 548, 568
- Amino acid efflux
  - and basolateral membrane transport, 112-13
- Amino acid residues
  - hydrophobic
    - and chemistry of gap junctions, 271
- Amino acid sequencing
  - and apolipoproteins, 776
- Amino acid transport
  - and metabolic substrates, 109-13
    - stimulated in hepatocytes
      - insulin mediators, 406
- Amino acids
  - basic
    - and electrochemical potential gradient, 110-111
    - and IGF synthesis, 446
    - and metabolic substrates
      - and transport, 90
    - and substrate transport, 96-97
- Aminogenesis
  - and metabolic substrate transport, 119
- Aminopeptidase
  - differential curves for
    - figure, 252
  - and ontogeny of intestinal enzymes, 235
- Aminopropyltransferase
  - and purine salvage, 692
- Ammonia
  - and acidosis, 158
  - and kidney mitochondrial transport, 153
- Amniotic fluid
  - and apolipoprotein in pulmonary surfactant, 784
- human
  - and apolipoproteins/pulmonary surfactants, 780
- L/S ratios
  - male/female discrepancy, 812
- studies of
  - and Respiratory distress syndrome, 803
- AMP
  - adenosine from
    - and nucleotide transport, 609
  - and adipocytes
    - in insulin receptor kinase, 374
  - conversion of
    - into INO, 729
  - metabolism of
    - and myokinase, 701
- AMP deaminase
  - in myocytes
    - purine salvage, 701
  - and platelet nucleotide metabolism, 687
  - yielding IMP, 618-19, 621
- AMP hydrolysis
  - and purine salvage, 699
- Amphibia
  - and gating potential
    - in gap junction functions, 291
- Amphiphilic polar lipids
  - and lamellar bodies, 753
- Anabolic processes
  - and insulin-like growth factors, 464
- Anaerobic glycolysis
  - and substrate-free anoxia, 738
- Androgens
  - and fetal sex
    - in lung development, 812
- Aneurin
  - as early tag for thiamin, 2
- Anion exchange
  - of ATPase purification
    - and calcium transport, 575
  - functional asymmetry of, 523
- Anion gradient elution
  - and adenine nucleotides
    - in platelet nucleotide function, 679
- Anion metabolites
  - and kidney excretion, 114
- Anion transport
  - and metabolic substrates, 113
  - possible mechanisms of, 528-29
    - see also Red blood cell anion transport
- Annual rhythms
  - definitions, perspectives, 67-69
  - historical aspects, 65-67
  - spectrum of relative roles, 70-76
  - summary, 76-77
- Anoxia
  - and ATP levels
    - in substrate transport, 93
  - comparison of
    - and ischemia, 740

- and creatine phosphate (CP), 727
- Anti-GH antibodies  
and hormone binding, 478
- Anti-GH receptor antibody  
and growth hormone receptors, 447-78
- Anti-insulin receptor antibodies  
insulin-like effects of, 407-8
- Antibodies  
against xanthine oxidase, 694  
from clones  
and apolipoproteins, 779  
and gap junction functions, 297  
see also Anti-insulin receptor antibodies
- Antibody-binding  
and insulin-like growth factors, 445
- Antibody cross-reactivity  
and human erythrocyte transporter, 507
- Antibody preparations  
anti-insulin receptor regulation, 366
- Antibody probes  
in gap junction communication  
antibodies of 27,000-dalton liver GJP, 307-12  
contribution of antibody probes, 312-15  
introduction, 305  
isolation and characterization of, 305-7  
prospects for the future, 315
- Antigen-antibody reaction  
and clonal heterogeneity  
in pulmonary surfactant, 780
- Antigens  
abnormal  
and colonic cell maturation, 190-91  
and apolipoproteins, 779
- Antipolypsis  
and insulin mediators, 417
- Antiport  
and mitochondrial creatine kinase, 718
- Antireceptor antibodies  
and IGF receptors, 426
- Antral gastrin concentration  
and gastric development, 211
- Aplysia  
and gap junction functions, 282
- APMB  
and RBC anion transport, 521
- Apolipoproteins of pulmonary surfactant  
composition and metabolism of  
composition of, 776-85  
conclusions, 786  
introduction, 775-76  
metabolism of surfactant apolipoproteins, 785
- Apology of a second-class man  
introduction, 1-2  
research, 9-14  
service, 6-9  
teaching and learning, 2-6
- Aromatic dicarboxylates  
specificity of  
and carboxylic acids, 129
- Artificial selection  
and *Homo sapiens*, 69
- Arylazido aminopropionyl ATP (ANAPP<sub>3</sub>)  
and cardiovascular nucleotide functions, 666
- Arylsulfatase  
and lung surfactant recycling, 793
- Asialoglycoprotein receptor  
and ligand internalization, 394
- Aspartate  
and kidney mitochondrial transport, 151
- Astroglial cells  
and Na<sup>+</sup>-H<sup>+</sup> exchanger, 545
- Asymmetry  
and glucose transporters, 511
- ATP  
and adenine nucleotide translocase  
in cardiac mitochondrial function, 652  
analogs of  
and affinity labeling of insulin receptors, 362  
and calcium transport, 573  
concomitant synthesis of, 536  
effects of  
on inhibition of ADP-stimulated respiration, 716  
induced contraction  
and adenine nucleotide uptake, 606  
loss of  
and loss of cell viability in regional ischemia, 738  
and Na-Ca exchange mechanism, 562  
synthesis of  
and the respiratory chain, 645
- ATP:ADP exchange  
and sodium pump, 536
- ATPase activity  
crossbridge-related  
in smooth muscle, 636
- ATPase chains  
and bidimensional crystalline arrays, 576
- ATPase cycle  
state of calcium binding during, 581
- ATP-dependent modulation  
of membrane conductance  
inside heart cells, 21
- ATP formation  
overall free energy requirement for, 583
- ATP hydrolysis  
in Ca-binding affinity, 586  
and contraction  
anoxia, 734  
free energy contributions of  
in calcium transport, 586  
and mechanisms of calcium transport, 573  
and sodium pump, 539
- ATP levels  
and myocardial function, 733
- ATP production  
and measured oxygen consumption, 656  
and phosphocreatine  
in the resting heart, 707  
regulation of  
by ADP availability, 713
- ATP secondary binding  
and calcium transport, 594
- ATP synthesis  
and cardiac mitochondrial function, 649
- ATP turnover  
rates of  
kidney, 155
- Autophosphorylation reaction  
insulin receptor  
activation of, 369
- Autoradiography  
and enterocyte development, 254
- ## B
- Band 3-catalyzed anion exchange  
kinetics of, 520-23
- Band 3 protein  
structure of, 523-28
- Barrett's epithelium  
as premalignant lesion, 176
- Basal glucagon secretion  
and junctional physiology, 344
- Basal pepsinogen secretion  
and gastric development, 205
- Basal secretion  
and gastric development, 200-1
- Basolateral membrane system

- and metabolic substrate transport, 105
- Basolateral membrane transport sites of, 112-13
- Basolateral membranes
  - and carboxylic acid transport, 133
  - and lactate transport, 138
- Basolateral transporters
  - see Metabolic substrates and transport
- Behavior patterns
  - and oscillatory neural networks, 29
- Bicarbonate
  - and kidney mitochondrial transport, 163
- Bidirectional signal transfer and junctional physiology, 343
- Bi-ionic diffusion potentials and succinate transport, 132
- Bile acids
  - as tumor-promoting agents in the colon, 185
- Binding
  - and transport
    - kinetics of, 107
- Binding isotherms
  - analysis of
    - and insulin receptor, 371
- Binding kinetics
  - and insulin receptors, 359
- Binding mechanisms and stoichiometry of Ca sites, 575
- Biochemistry
  - developmental
    - of lung maturation, 806-8
- Biosynthesis
  - and IGF receptors, 426
  - and type 1 IGF receptors, 435
- Birth
  - and basal acid secretion, 201
  - and enterocyte development, 253
- Bombesin tetradecapeptide and proliferation of antral gastrin cells, 178
- Bone growth
  - longitudinal
    - effects of GH on, 486-87
- Bound ligands
  - standard chemical potential of and calcium transport, 589
- Brain plasma membrane
  - sodium-calcium exchange in, 561
- Branched-chain amino acid-derived substrates
  - utilization of
    - by mitochondria, 649-50
- Breeding
  - see Annual rhythms
- Bronchoalveolar secretory products
  - and developmental aspects of lung lipids, 803
- Brush border membrane vesicles and metabolic substrate transport, 105-6
- Bursting pacemaker potentials (BPPs)
  - and oscillatory neural networks, 41
- C
- Calcium
  - depletion of
    - by EDTA, 226
    - and energy metabolism, 637
  - extrusion
    - and gap junction functions, 293
  - and gastric mucosa re-epithelialization, 225
  - and insulin mediators, 409
  - relative activation levels of, 24
  - sensitivity to
    - and reduction in intercellular coupling, 286-87
- Calcium binding
  - state of
    - during ATPase cycle, 581
- Calcium binding Equation I and consequent enzyme activation
  - in calcium transport, 579
- Calcium binding sites and ATP-dependent Na pump, 563
- Calcium channels
  - purine receptors linked to and cardiovascular nucleotide functions, 669
- Calcium complexation by SR ATPase, 585
- Calcium exchange
  - see Sodium-calcium exchange in plasma membrane vesicles
- Calcium homeostasis
  - and lethal injury, 739-40
  - and nucleotides and cellular damage, 735
- Calcium phosphate and nucleotides in cellular damage, 741
- Calcium transport
  - in cellular regulatory pathways, 561
  - mechanism of
    - conclusions, 595
    - coupling of enzyme and transport activities, 577-85
- introduction, 573-74
- sarcoplasmic reticulum
  - ATPase, 574-77
  - work of the pump, 585-95
- Calcium-activated neutral protease (CANP)
  - and nucleotides
    - in cellular damage, 739
- Calcium-calcium exchange
  - Na-Ca exchange mechanism catalyzing, 566
- Calliphora*
  - and gap junctions in development, 326
- Calmodulin
  - and calcium
    - in junctional physiology, 349
  - and gap junction functions, 294
- Calmodulin antagonists and gap junctional communication, 313
- cAMP
  - antagonist
    - and insulin mediators, 415-16
  - decrease in level
    - and GH, 493
  - and gap junctional conductance, 315
  - generation
    - and insulin mediators, 408-9
  - and growth of the early embryo, 330
  - and neural pacemakers, 21
  - role of
    - in modulating junction formation/permeability, 344
- cAMP-dependent kinase
  - in gap-junction formation, 295
- cAMP-dependent protein kinase and insulin mediators, 411
- dissociation of
  - and junctional physiology, 342
- phosphorylation pathway via and insulin receptors, 371
- and transfer of molecular signals
  - in junctional physiology, 341
- Cancer
  - and the colon, 184-87
  - in junctional physiology, 350
  - see also Colonic biopsies
- Capillary endothelial cells and  $\text{Na}^+\text{-H}^+$  exchanger, 545
- Carbachol
  - and circadian rhythm of locomotor activity, 57
  - and gastric development, 202

- and pepsin output, 205
- Carbodiimides
  - water-soluble
  - and RBC anion transport, 528
- Carbohydrate metabolism and endogenous GH regulating protein, 493
- Carbohydrate tolerance and hyperinsulinemia
  - direct actions of GH, 492
- Carbohydrates
  - and GH-receptors
  - chemical composition, 473
  - and ontogeny of intestinal enzymes, 235
- Carbonic anhydrase and CO<sub>2</sub> excretion, 519-20
  - early research, 10
- Carbonyl oxygens and mechanisms of calcium transport, 591
- Carboxyatractyloside and kidney mitochondrial transport, 150
- Carboxylic acids
  - transport of by renal membrane vesicles
  - conclusion, 138-39
  - introduction, 127-28
  - Krebs-cycle intermediates, 129-34
  - membrane vesicles, 128-29
  - monocarboxylic acids, 134-38
- Cardiac cells
  - mitochondrial activity in, 645
- Cardiac glycoside binding and ion movements
  - through sodium pump, 535
- Cardiac mitochondria
  - structural and functional compartments, 646
- Cardiac sarcolemmal vesicles
  - calcium uptake in
  - Na-dependent, 562
- Cardiovascular nucleotide functions
  - see Nucleotides in heart and blood vessels
- Carnitine
  - metabolic role of
  - in cardiac mitochondrial function, 650
- Carnitine-palmitoyl-transferase and cardiac mitochondrial function, 651
- Carrier model and glucose transporter, 509
- Carrier proteins
  - binding capacity of
  - and IGF, 451
- Catabolism
  - of adenine nucleotides
  - in endothelial cells, 617
- Catalysis
  - multistep mechanism of
  - in calcium transport, 587
- Catalytic cycles
  - reversal of
  - in calcium transport, 583
- Catalytic transport cycle
  - free energy changes in, 587
- Catecholamines
  - and insulin receptors, 371
- Cation transport
  - and metabolic substrates, 115
- Cation-hydroxyl cotransport
  - kinetic models of
  - figure, 551
- Cationic proteins
  - and vascular permeability
  - in nucleotide release, 623
- Cations
  - occluded
  - and sodium pump, 541
  - and pharmacology of gap junction channels, 292-97
- cDNA
  - isolation of clones
  - and antibody probes for gap junctions, 315
  - nucleotide sequence of
  - and chemistry of gap junctions, 271
- CDP-choline
  - and metabolic reutilization, 797
- Celiac disease
  - and gastrointestinal cell growth, 181
- Cell cycling
  - and ontogeny of intestinal enzymes, 241
- Cell damage
  - see Nucleotides and cellular damage
- Cell differentiation
  - effect of GH on, 490-91
- Cell growth
  - and physiological roles of permeable junctions, 337
- Cell homeostasis
  - and importance of nucleotide uptake, 605
- Cell multiplication
  - and role of IGF receptors, 436
- Cell patterning
  - and gap junctions in development, 328
- Cell proliferation
  - and differentiation
  - studies, 187-92
  - in nonskeletal tissue
  - effects of GH on, 489-90
- Cell surface events
  - and ligand internalization, 384
- Cell suspensions
  - and metabolic substrates and transport, 87
- Cellular energy production
  - see Metabolic substrates and transport
- Cellular regulatory pathways and calcium transport, 561
- Cellular respiration
  - relationship to coronary blood flow
  - in cardiac mitochondrial function, 657
- Cell volume
  - and organic-solute transport, 117-18
- Central neurons
  - and rhythmic frequencies, 18
- Central pattern generators (CPGs)
  - and oscillatory neural networks, 29
- Cervus nippon*
  - circannual cycle, 72
- cGMP
  - effects of
  - studies, 22-23
  - and insulin mediators, 409
- C-guanine nucleotides
  - formaldehyde-induced breakdown of
  - figure, 684
- Charge displacement
  - and electrolyte exchange
  - in calcium transport, 584
- Charge selectivity
  - and gap junction function, 282
- Chironomus*
  - and gap junction functions, 287, 291
  - and group-specific protein reagents, 293
- Chloride transport
  - and water-soluble carbodiimides
  - in anion transport, 528
- Cholate
  - and glucose transporters
  - reconstitution by, 504
- Cholesterol
  - synthesis of endogenous form
  - studies, 771
- Choline
  - and calcium-calcium exchange, 566
  - and fetal lung development, 808
- Choline acetyltransferase
  - and SCN, 57
- Choline kinase
  - rate-limiting role of
  - and surfactant lipid synthesis, 769
- Cholinephosphate cytidylyltransferase

- and PC biosynthesis regulation
  - translocation of, 769
- Cholinephosphate pool
  - and rate-limiting steps
    - in surfactant lipid synthesis, 769
- Cholinephosphotransferase
  - and disaturated DG, 767
- Cholinergic agonist
  - and regulation of secretion
    - and lung surfactant recycling, 794
- Cholinergic receptors
  - and circadian neural rhythms, 57
- Chondrocytes
  - and growth hormone receptors, 471
  - and insulin-like growth factors, 448
- Chondrogenesis
  - and direct action of GH, 487
- Chromaffin tissue
  - and nucleotide release, 611
- Chromatographic purification
  - and glucose transporter, 504
- Chromatography
  - DEAE-cellulose
    - and glucose transporters, 504
  - liquid
    - and trypsin hydrolysis, 373
- Chronic acidosis
  - and the kidney, 156-57
- Chronic growth effects
  - and role of IGF receptors, 436
- Chronic metabolic acidosis
  - and kidney mitochondrial transport, 157
- Chymotrypsin
  - high bilateral
    - and anion transport, 526
  - proteolysis with
    - and RBC anion transport, 524
  - treatment of lens junctions
    - with, 273
- Cimetidine
  - and gastric development, 201
- Circadian centers
  - entrained and free-running, 59
- Circadian neural rhythms
  - introduction, 49-50
  - other circadian centers, 59
  - summary, 60-61
  - suprachiasmatic nucleus, 50-59
- Circadian pacemakers
  - and apparent circannual pacemaker systems, 68
- Circannual rhythm
  - definition of, 67
- Circulating hormones
  - and neural pacemakers, 23
- Citrate
  - and carboxylic acid transport, 133
- Citrate oxidation rate
  - in renal cortex
    - figure, 97
- Citric acid cycle
  - and metabolic substrates, 143
- C-labeled deoxyglucose technique
  - and glucose utilization
    - and SCN metabolic activity, 54
- Cl-HCO<sub>3</sub> exchange
  - in CO<sub>2</sub> excretion
    - RBC anion transport, 519
- Clonal heterogeneity
  - and antigen-antibody reaction
    - in pulmonary surfactant, 780
- CO<sub>2</sub>
  - and glucose, 92
- CO<sub>2</sub> excretion
  - and role of Cl-HCO<sub>3</sub> exchange, 519
- CO<sub>2</sub> production
  - creatine stimulated
    - in muscle, 708
- CO<sub>2</sub> production rates
  - and oxygen consumption
    - in metabolic substrates, 87
- CoA (CoASH)
  - and cardiac mitochondrial function, 652
- Colchicine
  - and inhibition of secretion of PC
    - and lung surfactant recycling, 794
- Colitis
  - and colon disease, 184
- Collagen
  - and isolating gap junctions, 265-66
- Collagenase
  - and gap junctional communication, 306
- Colon disease
  - and gastrointestinal cell growth, 184-87
- Colonic adenocarcinomas
  - and gastrointestinal cell growth, 185
- Colonic cell maturation
  - and genetic markers, 190-91
- Compartment hypothesis
  - and gap junctions, 325-28
- Concanavalin A
  - and antibody probes for gap junctions, 307
- Concanavalin A agarose
  - and cardiac mitochondrial function, 658
- Conditional bursters
  - and oscillatory networks, 30-32
- Conformational changes
  - and calcium transport, 592
- Conformational transitions
  - and occluded cations
    - sodium pump, 541
- Congenital bleeding disorder
  - and calcium
    - in platelet nucleotide metabolism, 681
- Contractility
  - and ATP hydrolysis, 734
- Contralateral nephrectomy
  - and metabolic substrate transport, 119
- Coronary blood flow
  - and cardiac mitochondrial function, 658
  - postulated regulator of
    - and myocardial nucleotide transport, 605
  - relationship to cellular respiration, 657
- Coronary endothelial cells
  - and purine salvage, 693
- Coronary flow rate
  - and nucleotides
    - in cell damage, 728
- Coronary vasculature
  - and extracellular ATP, 607
- Cortical metabolic pathways
  - characterization of, 86-87
- Corticosterone
  - and gastric development, 202, 209
  - and ontogeny of intestinal enzymes, 236
- Cortisol
  - and fetal lung development, 810
- Coupled transport
  - in mechanisms of calcium transport, 587
- Coupling
  - see Pharmacology of gap junctions
- Covalent labeling
  - and glucose transporters, 506
- Creatine kinase reaction
  - and energy metabolism, 630
  - equilibrium of
    - and insignificant changes in ATP, 720
- Creatine phosphate (CP)
  - and anoxia, 727
  - and cardiac mitochondrial function, 659-60
- Creatine-phosphate shuttle
  - importance of
    - in coronary flow, 660
- Cross linking methodologies

- and growth hormone receptors, 478
  - Crossbridge cycling
    - under isometric conditions and energy metabolism, 636
  - Crossbridge cycling rate and control of energy usage, 637-38
  - Crypt-villus axis
    - and enterocyte development, 251
  - Cultured chondrocytes
    - in vitro effects of GH on, 487
  - Cyclic nucleotide metabolism and direct actions of GH, 493
  - Cyclic nucleotides
    - putative morphogens in and gap junction functions, 282
    - see also cAMP
  - Cysteine residues
    - and RBC anion transport, 527
  - Cytochalasin B
    - effect of photolabeling with and glucose transporter, 510
    - and human erythrocyte transporter, 507
  - Cytochalasin B binding and glucose transporters, 504
  - Cytochemistry
    - and enterocyte development, 251
  - Cytoplasmic acidification and membrane permeant esters in gap junction functions, 286
  - Cytoplasmic adenine nucleotides and platelet nucleotide metabolism, 683
  - Cytoplasmic membrane surfaces and Na-Ca exchange, 563
  - Cytoplasmic metabolites
    - diffusion of and gap junctions in development, 330
  - Cytoplasmic nucleotide pools and metabolic blockers in platelet nucleotide metabolism, 680
  - Cytoplasmic pH and gap junctions in development, 331
  - Cytosol
    - and metabolic substrates, 88
  - Cytosolic hypoxanthine metabolism of and purine salvage, 693
  - Cytosolic 5' nucleotidase and cellular damage, 733
  - and xanthine (XAN) production, 731
  - Cytosolic phosphorylation potential
    - regulation of mitochondrial respiration by, 654-55
- D**
- D-lactate transport
    - benzoic acid inhibition in the kidney, 137
  - Daphnia*
    - and gap junctions in development, 329
  - DEAE-cellulose chromatography
    - and glucose transporter, 504
  - Debinding
    - and Na<sup>+</sup>-H<sup>+</sup> exchange, 550
  - Decrementless conduction in the "Frog Jumps" laboratory, 3
  - Degradation
    - and macromolecular synthesis in cellular damage, 736
  - Dehydroepiandrosterone sulfate (DHEAS)
    - and fetal adrenal lung lipids development, 809
  - Deoxycholate dialysis and glucose transporters reconstitution by, 504
  - 2-deoxyglucose accumulation
    - and insulin-like growth factors, 450
    - and symmetric carriers model glucose transporter, 512
  - Dephosphoenzyme and ion movements through sodium pump, 535
  - Dephosphorylation
    - K-promoted and sodium pump, 537
  - Desensitization
    - and protein chemistry of insulin receptor, 360-68
  - Detergent
    - isolation of gap junctions without, 265
    - isolation procedures utilizing in gap junctions, 264-65
  - Developmental aspects of lung lipids
    - developmental biochemistry of lung maturation, 806-8
    - endocrinology of fetal development, 808-11
    - influences on timing of fetal lung development, 811-16
    - introduction, 803-6
    - summary, 816
  - Dextran
    - fluoresceinated and gap junction functions, 287
  - Diabetes mellitus
    - effect of on insulin-mediator generation, 415
    - as pathologic metabolic states causal factors, 650
    - see also Metabolic substrates transport of by the proximal nephron
  - Diaminobenzidine
    - and ligand internalization, 396
  - Diazepam
    - and human coronary blood flow, 672
  - Diazoxide
    - and dye coupling in junctional physiology, 346
  - Diel rhythms
    - as circadian, 67
  - Diet
    - adaptive responses to, 252
    - effect of on insulin-mediator generation, 415
    - and gastric development, 208
    - and regulation of enzymic changes, 234-41
  - Diethyl pyrocarbonate (DEP) and succinate uptake, 130
  - Diethylstilbestrol
    - and glucose transporters, 511
  - Digestive and absorptive function
    - in differentiating enterocytes conclusion, 257
    - different aspects of enterocyte development, 247-56
    - integrative aspects of enterocyte development, 256-57
    - introduction, 247
  - Digitonin
    - and mitochondrial metabolite carriers, 162
  - Dihydrotestosterone (DHT) and fetal surfactant production, 813
  - Diisopropyl fluorophosphate-treated trypsin and insulin mediators, 407
  - Dioleoyl-PC and glucose transporter, 505
  - Dipalmitoylphosphatidylcholine (DPPC)
    - biosynthesis of and lung surfactant recycling, 791
    - and surfactant lipid synthesis, 765
  - Diphosphatase



- and extracellular nucleotide catabolism, 622
- Dipyridamole and adenosine uptake, 618-19
- Direct retinal projection of SCN
  - in nonrodent mammals, 51
- Disaccharidase and enterocyte development, 249
- Dissociation reactions and glide symmetry in carboxylic acid transport, 133
- Disuccinimidyl suberate and insulin receptors, 361
- Disulfide-linked moieties and growth hormone receptors, 474
- Disulfonic acid and RBC anion transport, 521
- Diuretic drug amiloride and  $\text{Na}^+ \text{-H}^+$  exchanger, 548
- Diurnal cortisol rhythm in SCN-lesioned rhesus monkeys, 52
- Diurnal fluctuations and circadian neural rhythms in mammals, 49
- Diurnal rhythms in SCN-lesioned animals and entraining agent, 59
- Diurnal temporal organization in SCN-lesioned animals, 51
- Divalent cation chelators
  - EDTA induced hemolysis and ATP release, 612
- Divalent cations and Na-Ca exchange, 564
- DNA
  - and direct action of GH, 485
  - and esophageal cells, 176
  - and gastrointestinal cell growth, 179
  - and IGF reacting with insulin receptor, 462
  - recombinant and calcium transport experiments, 595
  - synthesis and fibroblasts/IGF receptors, 425
    - in gastric mucosa, 177
    - and insulin-like growth factors, 448, 453
    - and role of IGF receptors, 436
  - stimulatory effect of GH on fibroblasts, 490
  - and thymidine incorporation in IGF receptors, 437
- DNP as a vasodilator, 658
- Downregulation of the Type I IGF receptor, 431
- Driver potentials see Plateau potentials
- Drosophila* and gap junctions in development, 326
- Duodenal fibroblasts and enterocyte development, 249
- Dye coupling in junctional physiology, 346 and study of gap junctional communication, 305
- E
  - Effector-sensitive regulatory proteins and antibody probes of gap junctions, 312
  - EGTA and calcium transport, 579
  - Electroneutral proton compensated transporters and swelling, 148
  - Electrogenicity and acidic amino acids, 111-12 and metabolic substrates, 105-6 and sodium-calcium exchange, 565
  - Electrolyte exchange and calcium transport, 584
  - Electron microscopy and living myocardium in cellular damage, 728
  - Electron transport and metabolic transport, 143
  - Electron-transfer activity mitochondrial regulation of, 648-53
  - Electroneutrality and ion transport, 546
  - Electrophoretic transporter and the kidney, 149
  - Electrotonic conduction and oscillatory neural networks, 34
  - Embryogenesis and appearance of gap junctions, 319
  - Embryology of the small intestine, 231-32
  - Embryonic development early gap junctions in, 323-25
  - Emotional stress and responses of blood flow, 4
  - Endocrine factors fetal influencing development, 806
  - Endocrinology of fetal development, 808-11
  - Endocytic tracer fluid phase and IgA linked receptor, 394
  - Endogenous burst-generating currents and neuronal oscillators, 44
  - Endogenous bursters and oscillatory networks, 30-32
  - Endogenous circannual rhythms see Annual rhythms
  - Endogenous rhythms see Circadian neural rhythms
  - Endoplasmic reticulum lysosome transfer of degradation products to, 798 and reversible translocation with cytosol, 772
  - Endosomal apparatus heterogeneity of and ligand internalization, 384-85 purification and properties of ligand internalization, 385-91 significance of internalization into ligand internalization, 394-96 see also Ligand internalization
  - Endothelial purine regulation and cardiovascular nucleotide functions, 670-71
  - Energy transduction in biological systems and calcium transport, 595
  - Energy usage partition into force-dependent and force-independent, 634-36 time course of, 633
  - Enterocyte development see Digestive and absorptive function
  - Enterocytes absorptive function of, 253-56
  - Environmental agents and circadian neural rhythms, 50
  - Environmental cycles see Annual rhythms
  - Enzyme dimerization and mechanisms of calcium transport, 594



- Enzyme phosphorylation
  - with ATP
  - and calcium transport, 579
  - and calcium transport, 592
- Epidermal growth factor (EGF)
  - and ontogeny of intestinal enzymes, 240
- Epinephrine
  - and surfactant secretion, 794
  - and use of insulin
  - to suppress glucogenesis by, 409
- Epiphyseal growth plate
  - site of action of GH in, 488-89
- Epithelial glucose transporter
  - and metabolic substrates, 109
- Equilibrium
  - and kinetic measurements
  - and calcium transport, 595
- Equilibrium thermodynamics
  - and mitochondrial creatine kinase, 723
- Erythrocytes
  - and glucose transporters
  - light-scattering assays, 508
- Erythroid cells
  - and insulin-like growth factors, 458-60
- Erythroid proliferation
  - murine
  - and direct action of GH, 489
- Esophageal disease
  - and gastrointestinal cell growth, 176
- Esophagus
  - and gastrointestinal cell growth, 176
- Estrogen
  - and fetal lung development, 808
- Estrogen treatments
  - and U23HdThd
  - into colonic epithelial cell DNA, 183
- Ethanol
  - and rat gastric mucosa figure, 221
- Ethanol/diethyl ether
  - and apoproteins
  - of pulmonary surfactant, 777
- Ethanol injury
  - restitution of figure, 223
- Ethanolaminephosphotransferase
  - and surfactant lipid synthesis, 771
- Ethylenediaminetetraacetic acid (EDTA)
  - and nucleotides in heart and blood vessels, 665
- Eukaryotic cells
  - and calcium transport, 573
- Evolutionary adaptations
  - to survival
  - in annually periodic environments, 77
- Excretion
  - see Red blood cell anion transport
- Exocytosis
  - and plasma glucose concentration
  - insulin-like growth factors, 446
  - and surfactant apolipoproteins, 785
- Exogenous epidermal growth factor (EGF)
  - and gastrointestinal cell growth, 189
- External calcium concentration
  - force output and energy usage as function of, 636-37
- Extracellular nucleotide catabolism
  - and endothelial cells, 622
- Extracellular purine levels
  - and nucleotides in heart and blood vessels, 665
- Extramitochondrial phosphorylation potential
  - and mitochondrial creatine kinase, 709
- F
- F-actin oligomer
  - and ADP
  - in platelet nucleotide metabolism, 684
- Fasting
  - effect of
  - on insulin-mediator generation, 415
  - on proliferation of antral gastrin cells, 178
- Fatty acids
  - $\beta$ -oxidation of
  - and metabolic role of carnitine, 650
  - and ketones
  - in metabolic substrates, 94-95
  - nutritional substrates derived from, 660
- Fatty-acid oxidation
  - and renal function, 92
- Fenn effect
  - under isometric conditions
  - in energy metabolism, 639
- Fetal adrenal
  - and dehydroepiandrosterone sulfate
  - in lung development, 809
- Fetal development
  - and surface active phospholipid, 784
- Fetal growth
  - and development of GH dependence, 484
- Fetal lung development
  - morphological pattern and timing of, 804-5
- Fetal lung fluids
  - proteins in
  - and pulmonary surfactant, 783
- Fetal sex
  - and androgens
  - lung development, 812-13
- Fibrin network
  - and re-epithelialization, 224
- Fibroblast monolayer cultures
  - and IGF receptors, 427
- Fibroblast pneumocyte factor
  - in fetal lung maturation, 816
- Fibroblast production
  - and enterocyte development, 256
- Fibroblasts
  - 3T3
  - and growth hormone receptors, 470
  - human
  - and insulin-like growth factors, 448
  - see also  $\text{Na}^+\text{-H}^+$  exchanger
- Fisheries
  - and annual rhythms, 65
- Fixation methods
  - see Ultrastructure of surfactants
- Fluorescein-tagged protein (F:PKI)
  - and transfer of molecular signals
  - junctional physiology, 341
- Fluorescent nucleotides
  - and sodium pump, 537
- Fracture healing
  - and insulin-like growth factors, 464
- Free adenosine
  - and nucleotide synthesis
  - in transport, 611
- Free creatine
  - and phosphocreatine
  - in energy metabolism, 631
- Free fatty acids
  - and insulin-like growth factors, 461
- Free-energy changes
  - and catalytic/transport cycle
  - calcium transport, 587
- Free-energy utilization
  - and calcium transport, 585

- Freeze-fracture methods  
and gap junctional plaques,  
323
- Freeze-substitution  
and perfusion-fixed lungs, 760
- Frequency adaptation  
see Repetitive firing properties
- Friesen-Stent model  
and oscillatory neural net-  
works, 31
- Fucus*  
and oocyte gap junctions,  
321-23
- Fuller Albright  
works of  
and early physiology, 4
- Functional coupling  
and mitochondrial creatine  
kinase, 719
- Fundulus*  
and antibody probes for gap  
junctions, 313  
and gap junctions in develop-  
ment, 324
- G
- Gall bladder  
epithelium  
and restitution, 228
- Gap junction channels  
gating of, 284-92  
gating properties of  
and gap junction function,  
283  
pharmacology of, 292-97
- Gap junction polypeptides  
in communication-defective  
cell lines, 314-15
- Gap junction proteins  
molecular weights, 267-69
- Gap junctional conductance  
antibody-induced perturbation  
of, 311-12  
mechanisms of regulation  
and antibody probes, 312-  
15
- Gap junctional connectivity  
and oocyte and follicle cells,  
322
- Gap junctions  
chemistry of  
conclusions, 274  
introduction, 263-64  
isolation procedures, 264-66  
junction constituents, 266-  
67  
properties of, 267-70  
structure of junction pro-  
teins, 270-74  
communication  
and the embryonic state,  
320  
and developmental compart-  
ments, 325-28  
gating properties of  
figure, 285  
isolation and characterization  
of, 305-7  
nonprotein components of,  
267  
pharmacological controls oper-  
ating on  
figure, 288-89  
see also Pharmacology of  
gap junctions  
role of in development  
conclusions, 330-31  
gap junctions and develop-  
mental compartments,  
325-28  
gap junctions in early  
embryonic develop-  
ment, 323-25  
introduction, 319-21  
loss of gap junctions during  
tissue differentiation,  
328-30  
oocyte gap junctions, 321-  
23
- Gastric acid  
development of  
in the two sexes, 210
- Gastric acid secretion  
and gastric development, 199
- Gastric development of the stom-  
ach  
acid, 200-4  
gastrin, 205-8  
introduction, 199-200  
pepsinogen, 204-5  
regulation, 208-11  
summary, 211-12
- Gastric mucosa  
frog  
figure, 220  
mucosal epithelial cells of  
renewal rates, 177
- Gastric mucosal barrier  
early research, 10-11  
studies of, 228
- Gastric mucosal re-  
epithelialization  
factors that influence resti-  
tution, 223-27  
implications of restitution,  
227-28  
introduction, 217-18  
what is restitution, 218-23
- Gastrin  
and gastric development, 205-  
8
- Gastrin receptors  
development of  
in the two sexes, 210
- Gastrin release  
and gastric development of the  
stomach, 207
- Gastritis  
and gastrointestinal cell  
growth, 179
- Gastrointestinal biopsies  
improved organ culture of,  
187-88
- Gastrointestinal cell growth  
esophagus, 176  
introduction, 175  
large intestine, 181-87  
recent developments, 187-92  
small intestine, 180-81  
stomach, 177-80
- Gating mechanisms  
and pH sensitivity, 290
- Gene duplication  
and insulin-like growth fac-  
tors, 460
- Gene identification  
and calcium transport, 595
- Genetics  
and fetal lung development,  
805  
and gastric development, 211  
and IGF receptors, 436  
manipulation of  
and metabolic substrate  
transport, 109
- Gestation  
and gastric development  
of the stomach, 204
- Gestational age  
and fetal lung development,  
811
- GH dependence  
development of  
fetal life, 484
- GH fragments  
and radioreceptor assays  
peptide binding, 473
- GH receptors  
multiple  
studies, 476  
see also Pituitary growth hor-  
mone
- GH-receptor genes  
cloning of  
and growth hormone recep-  
tors, 478
- Glibenclamide  
and junctional physiology,  
346
- Glomerular cells  
metabolic effect on  
and glucose, 93
- Glomerular filtration rate (GFR)  
and absorption of salt, 117
- Glomerulotubular balance  
and metabolic substrates, 104
- Glucagon  
A-cell secretion of

- junctional physiology, 344
- and insulin
  - as antagonist, 408-9
- Glucosylase
  - and enterocyte development, 251
- Glucocorticoid hormones
  - in ontogeny of intestinal enzymes, 235
- Glucocorticoids
  - exogenous
    - and prevention of neonatal RDS, 804
  - and gastric development, 209
- Gluconeogenesis
  - and fatty acids
    - in metabolic substrates, 98
  - and renal metabolism, 155-56
- Glucose
  - and the Embden-Meyerhof pathway, 89
  - and metabolic substrates, 92-93
  - nutritional substrates derived from
    - and cardiac mitochondrial function, 660
  - and surfactant lipid synthesis, 766
  - synthesis of
    - in kidney mitochondrial transport, 151
    - and substrate transport, 91
  - utilization of
    - and cardiac mitochondrial function, 649
- Glucose intolerance
  - and Streptozotocin (STZ)
    - lung lipid development, 815
- Glucose metabolism
  - and insulin-like effects of IGF, 449
  - and insulin-like growth factors, 463
- Glucose oxidation
  - and multiple GH receptors, 476
- Glucose starvation
  - and glucose transporters, 508
- Glucose threshold
  - and junctional physiology, 347
- Glucose transport
  - and insulin-like growth factors, 450
  - and insulin mediation, 406
  - and renal cortex studies, 104-9
- Glucose transporter
  - of mammalian cells
    - identification, reconstitution, 503-8
  - introduction, 503
- kinetics and mechanisms, 508-12
  - summary, 512-13
- and metabolic substrates
  - by the proximal nephron, 103
- Glucose utilization
  - and C-labeled deoxyglucose technique, 54
- Glucose-reversible cytochalasin B binding
  - techniques of reconstitution, 506-7
- Glucose-transport protein
  - isolation and purification of, 108
- Glucosides, C-1,
  - and transport kinetics, 512
- Glutamate carriers
  - in renal metabolism, 158-61
- Glutamate dehydrogenase flux
  - and kidney mitochondrial transport, 161
- Glutamine
  - and metabolic substrates, 90
- Glutamine transporter
  - and kidney mitochondrial transport, 157-58
- Glutamine uptake
  - and metabolic substrates, 97
- Glutaraldehyde
  - and controls of gap junction function, 295
  - and cross-linked tritiated amino acids, 254
- Gluten enteropathy
  - and gastrointestinal cell growth, 181
- Glycerophosphate acyltransferase
  - and cardiac mitochondrial function, 647
- Glycine
  - and L-proline, 110
- Glycogen
  - and insulin-like growth factors, 450
  - and intracellular substrates in the fetal lung, 814
  - and respiratory distress syndrome, 804
  - and substrate transport, 91
- Glycogen synthase
  - and insulin mediators, 407, 410
  - and insulin receptor function, 357
- Glycogenolysis
  - and substrate-free anoxia, 738
- Glycolysis
  - and energy metabolism, 630
  - and formation of ATP, 685
- Glycolytic metabolism
  - compartmentalization of and energy metabolism, 632
- Glycoprotein
  - and apolipoproteins
    - of pulmonary surfactant, 783
  - and hydroxyproline
    - lung surfactant recycling, 792
  - and IGF receptors, 429
- Glycosylation site
  - N-linked
    - and chemistry of gap junctions, 272
- GMP
  - metabolism of
    - and purine salvage, 700-1
- Gonadal development
  - photoperiodic induction of, 66
- Graded transmitter release
  - and oscillatory neural networks, 42
- Gradient technique
  - in platelet nucleotide metabolism, 679
- Granular pneumocytes
  - and assembly of lung surfactant lipids, 789
  - and metabolic reutilization in lung surfactant recycling, 797
- Granulogenesis
  - and platelet nucleotide metabolism, 682
- Growth
  - and gastric development, 207-8
- Growth factors
  - see Insulin-like growth factors
- Growth-hormone levels
  - as major regulatory factor of IGF serum concentration, 447
- Growth-promoting effects
  - of IGFs in vivo, 454
  - of insulin-like growth factors, 453
- Guanine
  - metabolism of
    - in purine salvage, 694
  - production of
    - and purine salvage, 698
  - salvaged by HGPRT
    - and purine salvage, 692-93
- Guanine nucleotides
  - and nucleotide metabolism, 678
- Guanosine
  - metabolism of
    - in purine salvage, 697
- Guanosine kinase
  - and purine salvage, 697

- H**
- H<sub>2</sub>O<sub>2</sub>**  
and insulin mediators, 410
- Haldane open-circuit method**  
early research, 3
- Heart**  
and chemistry of gap junctions, 269  
see also Myocardial nucleotide transport  
see also Nucleotides in heart and blood vessels
- Heart gap junctions**  
and 29,000-dalton polypeptide, 310
- Heart metabolism**  
role of creatine kinase in, 708
- Heart mitochondrial respiration**  
stimulated by endogenous CK<sub>m</sub>  
figure, 714
- Hemoglobin**  
and mitochondrial respiratory activity, 654
- Hemolysis**  
EDTA induced  
and ATP release, 612
- Hepatectomy**  
and phorbol esters  
in chemistry of gap junctions, 268
- Hepatocytes**  
and inhibitor titrations  
kidney mitochondrial transport, 153
- Hepatoma**  
rat  
and upregulation of type II IGF, 433
- Heterogeneity**  
clones  
and pulmonary surfactant, 779
- Heteropneustes fossilis***  
circannual cycle in ovarian function, 72
- Heterotypic gap junctions**  
and permeable junctions physiology, 342
- Hexokinase**  
and ADP-generating system, 711
- High binding capacities**  
and direct actions of GH, 484
- High energy phosphate metabolism**  
aspects of integration of, 719-21  
in vascular smooth muscle compartmentalization, 632  
energy usage/isometric conditions, 633-38
- energy usage/shortening, 639
- energy usage/stimulation, 640
- general comments on, 633
- introduction, 629
- relationship between high-energy phosphate utilization, 629-31
- see also Mitochondrial creatine kinase
- Hill plot analysis**  
and sodium-calcium exchange, 564
- Histadine residues**  
and chemistry of gap junctions, 274
- Histamine**  
and energy metabolism, 634  
and gastric development, 203-4  
and re-epithelialization, 224  
and stimulation of H<sup>+</sup> secretion, 219
- Histidine decarboxylase**  
and gastric development, 203-4
- Histidyl residues**  
and carboxylic acid transports, 139
- Histidyl residue**  
and succinate-binding sites, 130
- HN neurons**  
and heartbeat rhythm pattern, 37
- Homeotherms**  
and circannual rhythm, 69
- Homo sapiens***  
and artificial selection, 69
- Hormone-activated proteolysis**  
and insulin mediators, 418
- Hormone receptor theory**  
and ligand binding, 366
- Hormone-sensitive lipase (HSL)**  
dephosphorylation of  
and direct action of GH, 492
- Hormones**  
and enterocyte development, 257  
and fetal lung development, 805  
and gap junction functions, 296  
and gastric development, 209
- Horseradish peroxidase**  
and chemistry of gap junctions, 284  
and ligand internalization, 396
- HPLC gradient separation**  
of acid-soluble nucleotides  
figure, 679
- Human coronary blood flow**  
and diazepam  
in cardiac nucleotide functions, 672
- and glucose transporters, 503
- Human growth hormone**  
and placental lactogen  
in peptide mediator, 416
- Human Physiology**  
origin of the Vander-Sherman-Luciano textbook, 8
- Human serum albumin**  
and insulin-like growth factors, 458
- Hyaline Membrane Disease**  
see Respiratory Distress Syndrome
- Hybridoma clones**  
and insulin receptors, 367
- Hydra morphogens**  
and gap junctions in development, 320
- Hydrochloric acid**  
and gastric development, 199
- Hydrocortisone**  
and gastric development, 209  
and ontogeny of intestinal enzymes, 237
- Hydrolysis**  
of alveolyn  
and apolipoproteins, 783
- Hydrolytic cleavage**  
and calcium transport, 577
- Hydrophobic helices**  
and glucose transporters, 513
- Hydroxyproline**  
and glycoproteins  
lung surfactant recycling, 792
- Hyperemia**  
and gastric mucosa re-epithelialization, 227  
and vasodilation  
in cardiovascular nucleotide function, 666
- Hypergastrinemia**  
and gastric development of the stomach, 203
- neonatal  
and gastric development, 206
- Hyperglycemia**  
maternal  
and lung lipids, 815
- Hyperinsulinemia**  
and direct action of GH, 492
- Hyperosmolar damage**  
and gastric mucosal re-epithelialization, 227
- Hyperplasia**

- in the colon
  - and gastrointestinal cell growth, 185
- Hyperventilation
  - and surfactant secretion
  - lung surfactant recycling, 795
- Hypoglycemia
  - and IGF in vivo, 451-52
- Hypophysectomy
  - and GH dependence, 484
- Hypothalamus
  - and circadian neural rhythms, 50
- Hypothyroidism
  - and ontogeny of intestinal enzymes, 239
- Hypoxanthine
  - ATP/AMP metabolized to in myocardial nucleotide transport, 609
  - and endothelial nucleotide metabolism, 621
  - and gap junctional physiology, 340
  - metabolism of
    - and purine salvage, 693
    - and myocardial nucleotide transport, 605
  - and nucleotide formation, 685
  - production of
    - and purine salvage, 698
  - radiolabeled
    - and junctional physiology, 339
- Hypoxanthine-guanine phosphoribosyltransferase (HGPRT)
  - and purine salvage, 692-93
- Hypoxanthine phosphoribosyl transferase (HPRT)
  - and junctional physiology, 339
- Hypoxia
  - and energy requirement for secretion, 795
  - substrate delivery during
    - and cellular damage, 727
- I
- Ia antigen
  - and differentiating enterocytes, 248
- Identification methodology
  - and glucose transporters, 503
- IGF
  - insulin-like effects of
    - and glucose transport, 449
  - subcutaneously administered
    - growth-promoting effects of, 455-57
  - IGF and platelet-derived growth factor (PDGF)
- insulin-like growth factors, 453
- IGF carrier protein
  - and affinity cross-linking technique, 427
- IGF receptor-mediated response
  - by insulin
    - postbinding regulation of, 438
- IGF receptors
  - see Insulin-like growth factors (IGF)
- IgG antibody
  - preimmune
    - and gap junctions, 311
- Immune complexes
  - and LDL pathway, 383
- Immunocytological techniques
  - and antibody probes for gap junctions, 310
- Immunoglobulins
  - anti-idiotypic
    - and insulin receptor regulation, 366
  - anti-insulin receptor
    - and acanthosis nigricans, 367
- Immunological cross-reactivity
  - and insulin-like growth factors, 445
- Immunological transfer techniques
  - and apolipoproteins
    - of pulmonary surfactant, 778
- Immunoprecipitation
  - with anti-insulin receptor serum
    - and insulin receptor regulation, 361
- Immunoreactive gastrin
  - appearance of in gestation, 206
- Immunoreactivity
  - and IGF receptors, 433
- Immunoreplica analyses
  - and liver gap junction polypeptides, 308-9
- IMP
  - metabolism of
    - and purine salvage, 699-700
- Indomethacin
  - and gastric mucosal re-epithelialization, 226
- Infants
  - at birth
    - serum gastrin in, 206
  - of diabetic mothers
    - and lung lipid development, 815
- Inflammation
  - and restitution, 218
- Inhibitor titrations
  - and adenine nucleotide carriers, 153
- Inhibitory synapses
  - and oscillatory neural networks, 31
  - and three-phase burst pattern of pyloric system
    - figure, 39
- INO production
  - determination of
    - during hypoxia, 732
- Inorganic phosphate
  - during early ischemia, 734
- Inosine
  - and endothelial nucleotide metabolism, 621
  - and myocardial nucleotide transport, 605
  - and platelet nucleotide metabolism, 686
  - and purine salvage, 697
- Inosine monophosphate (IMP)
  - and cellular damage, 729-33
- Insulin
  - acute upregulation of the Type II IGF receptor by, 432
  - desensitizing rat hepatoma cells, 439
  - and ontogeny of intestinal enzymes, 241
  - receptors for
    - in ligand internalization, 385
  - see also Ligand internalization
  - see also Na<sup>+</sup>-H<sup>+</sup> exchanger
  - Insulin action
    - intracellular mediators of
      - conclusions, 417-18
      - failure of known second messengers, 408-10
      - hormonal effects of mediator on intact cells, 417
      - insulin mediators, 410-16
    - introduction, 405
    - justification for, 405-8
    - putative prolactin peptide mediator, 416
  - Insulin binding
    - to cell-surface receptors
      - methods to assess, 358
    - monoclonal antibody that inhibits, 434
    - regulation of, 370-73
  - Insulin internalization
    - and degradation
      - required for insulin action, 405-6
  - Insulin-like growth factors
    - actions of
      - are they hormones, 445-48
      - chemistry of, 444-45

- circulating forms of, 448-49
  - conclusions, 460-64
  - effects of on differentiation of mesenchymal cells, 458-60
  - growth promoting effects of, 453-54
  - growth promoting effects of in vivo, 454-55
  - hypoglycemic effects of, 451-52
  - insulin-like effects, 449-51
  - introduction, 443-44
  - subcutaneously administered, 455-57
  - Insulin-like growth factors (IGF) receptors**
    - nature and regulation of
      - comparison between IgF receptor and insulin receptor, 433-36
    - identification of subtype, 426-28
    - introduction, 425-26
    - phosphorylation of, 429-31
    - physical characterization of, 428-29
    - postbinding regulation, 438
    - regulation of IgF receptors, 431-33
    - role of IgF receptors, 436-38
    - summary, 438-39
  - Insulin mediator**
    - hormonal effects of on intact cells, 417
    - insulin-like effects of figure, 412
    - justification for, 405-8
  - Insulin receptor**
    - and glucose metabolism
      - in insulin-like growth factors, 463
    - structure and function
      - general properties of, 358-60
      - introduction, 357-58
      - protein chemistry of, 360-68
      - regulation of, 370-75
      - summary, 375-76
      - tyrosine kinase, 368-70
  - Insulin receptor biosynthesis and monensin, 435**
  - Insulin receptor function**
    - regulation of, 370-75
  - Insulin receptor kinase**
    - hypothetical pathways figure, 372
  - Insulin release**
    - and junctional physiology, 346
  - Interactive kinetic analysis**
    - and enterocyte development, 255
  - Intercellular coupling**
    - reduction in
      - and sensitivity to calcium, 286-87
  - Interior peptide linkages**
    - and gastric development, 199
  - Intestinal lactate transport and carboxylic acid transports, 138**
  - Intestinal resection**
    - and enterocyte development, 256
  - Intracellular adenosine metabolic pathways**
    - in perfused organ studies
      - endothelial nucleotide metabolism, 618
  - Intracellular adenosine metabolism**
    - after adenosine uptake, 619
  - Intracellular Ca and neural pacemakers, 23-24**
  - Intracellular events**
    - and ligand internalization, 384
  - Intracellular K and cellular damage, 735**
  - Intracellular messengers**
    - and controls of gap junction functions, 296
  - Intracellular nucleotide catabolism**
    - and degradation of cellular ATP, 620-21
  - Intracellular pH**
    - and  $\text{Na}^+$ - $\text{H}^+$  exchanger, 557
  - Intracellular processing of surfactant lipids**
    - in the lung
      - assembly and storage of, 789-93
      - conclusions, 798
      - introduction, 789
      - removal and reprocessing of, 795-98
      - secretion of, 793-95
  - Intracellular solute composition and metabolic substrates, 118**
  - Intracellular transport**
    - of insulin and other ligands
      - control of, 391-92
  - Intramembrane particles (IMP) and ultrastructure of surfactant, 755**
  - Intramitochondrial metabolism and kidney mitochondrial transport, 162**
  - Intravenous infusion**
    - and substrate metabolism, 86
  - Ion gradients**
    - and cellular damage during ischemia, 734-36
  - Ion movement**
    - and study of gap junctional communication, 305
  - Ipsilateral HE cells and leech circulation, 36**
  - Ischemia**
    - comparison with anoxia, 740-41
    - and endothelial nucleotide metabolism, 621
    - see also Nucleotides and cellular damage
      - in myocardial ischemia
  - Ischemic cells**
    - and re-epithelialization, 224
  - Ischemic injury**
    - and coronary artery occlusion model
      - of myocardial ischemia, 728
    - irreversible
      - and adenine nucleotide degradation, 737-43
  - Ischemic myocardium**
    - effects of reperfusion on, 741
  - Ischemic myocyte death**
    - pathogenesis of, 739-43
  - Isolation procedures**
    - in gap junctions, 264-66
  - Isometric conditions**
    - energy usage under, 633-38
  - Isoproterenol**
    - and insulin receptor autophosphorylation, 374
  - Isotonic serosal fluid**
    - and the gastric mucosa, 220
- J**
- Junction polypeptides**
    - 27,000-dalton liver gap antibodies of, 307-12
  - Junction proteins**
    - purification of
      - and chemistry of gap junctions, 266-67
    - structure of
      - primary sequence, 270-71
  - Junctional communication and physiological processes**
    - in gap junctions, 338
  - Junctional polypeptide**
    - and 16,000-dalton protein, 268
- K**
- K-channels**
    - Ca and Ca-activated
      - and neural pacemakers, 19
  - $\text{K}^+$  depolarization**
    - and energy metabolism, 634
  - K-diffusion potentials**
    - with valinomycin

- sodium-calcium exchange, 565
- $\alpha$ -Ketoglutarate/malate transporter and kidney mitochondrial transport, 161
- Ketones
  - bodies and insulin-like growth factors, 461
  - utilization of cardiac function, 649
  - and metabolic substrates and transport, 90, 94-95
- Kidney
  - see Metabolic substrates in renal mitochondria
  - see Metabolic substrates and transport
- Kinase activity and growth hormone receptors, 472
- and purine salvage, 697
- Kinetic analysis and lung surfactant recycling, 796
- Kinetic models for  $\text{Na}^+$ - $\text{H}^+$  exchange, 549
- Kinetics and glucose transport, 106-8, 508-12
- K-K exchange and nonhydrolyzable ATP analogs, 540
- Krebs-cycle intermediates and carboxylic acids, 129-34
- and substrate transport, 96
- L
- Labile tissue and enterocyte development, 247
- Lactate
  - cotransport and carboxylic acid transport, 134
  - and metabolic transport, 93-94
  - and RBC anion transport, 520
- Lactate formation and insulin-like growth factors, 450
- Lactation
  - in tumor-bearing animals
  - junctional physiology, 347
- Lactogenic hormones and growth hormone receptors, 471
- Lactoperoxidase and RBC anion transport, 528
- Lamellar bodies
  - as an evolving metabolic pool, 776
  - and lung surfactant recycling, 791-92
  - and PLEPs from the lung, 790
  - and ultrastructure of alveolar surfactant, 753
- Langendorff heart preparation and aorta, 3
- Latchbridge hypothesis and energy metabolism, 638
- Lateral geniculate nucleus and afferent connections to SCN golden hamster, 56
- Learning
  - methods of and teaching, 2
- Lectin-receptor interactions and growth hormone receptors, 473
- Lens fiber junctions
  - model of chemistry of gap junctions, 271-72
- Ligand binding and hormone receptor theory, 366
- insulin receptor affinity during experiments, 359
- Ligand binding studies and adenosine receptor classification, 669
- Ligand interactions and ion movements through sodium pump, 535
- Ligand internalization
  - cell-surface events, 384
  - control of intracellular transport, 391-92
  - heterogeneity of endosomal apparatus, 384-85
  - introduction, 383
  - purification of endosomal apparatus, 385-91
  - receptor internalization and recycling, 393-94
  - significance of internalization, 394-96
- Ligands
  - localization of endosomal apparatus figure, 386
- Light chain phosphorylation and isometric contraction in energy metabolism, 638
- Limulus
  - and controls of gap junction functions, 291
- Lipid extraction
  - electron micrographs of figure, 755
- Lipid permeant anions and glucose transport, 106
- Lipid-protein association and lamellar bodies, 757
- Lipids
  - and pulmonary surfactant, 776
  - see also Surfactant lipid synthesis
- Lipogenesis and insulin mediators, 417
- Lipolysis
  - inhibition of and insulin mediators, 406
- Lipolytic activity and metabolic activities of GH, 491-93
- Lipoprotein
  - morphology of and ligand internalization, 391
  - regulating endogenous cholesterol synthesis, 771
- Liposomes and glucose-transport protein, 108
- Liquid crystal and tubular myelin, 759
- Lithium
  - effect of and carboxylic acids transport, 134
- Liver
  - and IGFs, 445
  - insulin receptor from sedimentation equilibrium properties of, 359
  - mitochondrial respiration figure, 713
  - regenerating and antibody probes for gap junctions, 313
- Liver gap junction polypeptide analysis of tissue and species specificity, 309-11
- characterization of, 308-9
- Lobster cardiac ganglion and oscillatory neural networks, 33
- Lobster pyloric system and oscillatory neural networks, 38-40
- Locomotor activity rhythm and SCN lesioned animals, 51
- Lohmann reaction and mitochondrial creatine kinase
- Lonchura punctulata*
  - reproductive functions in, 70
- Longitudinal bone growth
  - direct effects of GH on, 486-87
- Low density lipoproteins (LDL) and ligand internalization, 383
- and lung surfactant recycling, 797
- Lumens
  - and gastric mucosa, 218



- Luminal acid  
factors influencing restitution,  
223-25
- Luminal ethanol  
and gastric mucosa re-  
epithelialization, 223
- Lung  
see Intracellular processing  
of surfactant lipids in the  
lung
- Lung fluids  
fetal  
and apolipoproteins of pul-  
monary surfactant, 783
- Lung phospholipid synthesis  
substrates for  
and lung lipids, 807-8
- Lung surfactant  
secretion of  
recent studies, 793
- Lymnaea*  
and gap junctions in develop-  
ment, 324
- Lynn's hypothesis  
and apolipoproteins of pul-  
monary surfactant, 782
- Lysine residue  
reactive  
and RBC anion transport,  
526
- Lysosome  
and location of LDL recep-  
tors, 383  
and lung surfactant recycling,  
793  
and platelet nucleotide meta-  
bolism, 677  
receptor poor  
and ligand internalization,  
395
- M
- M, binding protein  
and growth hormone treat-  
ment, 457
- Macromolecular synthesis  
and cell damage, 736  
and myocardial function, 733
- Maculae communicantes  
see Gap junctions, chemistry  
of
- Major intrinsic protein (MIP)  
conceptualization of  
figure, 273  
deduced sequence of, 272  
model of lens fiber  
and chemistry of gap junc-  
tions, 271-72
- Maltose  
as inhibitor  
in glucose transporters, 511
- Mannitol  
direct effects of  
on ischemic myocytes, 743
- Marker-enzyme activity  
and ligand internalization, 391
- Marmota monax*  
annual cycles in hibernation,  
72
- Maternal diabetes mellitus  
and fetal lung development  
figure, 805
- Maternal metabolism  
and developmental aspects  
of lung lipids, 815
- Matrix adenine nucleotides  
and cell damage, 736
- Megakaryocytes  
and platelet nucleotide meta-  
bolism, 682
- Meiosis  
and cAMP  
antibody probes for gap  
junctions, 322
- Meiotic arrest  
preovulatory oocytes  
junctional physiology, 342
- Membrane depolarization  
and  $\text{Na}^+$ - $\text{H}^+$  exchange, 546
- Membrane domain  
and RBC anion transport, 524
- Membrane ion channel  
studies  
and neural pacemakers, 18
- Membrane permeant esters  
and cytoplasmic acidification  
gap junction functions, 286
- Membrane vesicles  
and carboxylic acids, 128  
and metabolic substrates, 88
- Mental illness  
and circadian system, 60
- Mesenchymal cells  
effects of IGFs on  
differentiation of, 458-60
- Mesenchyme induction  
of enterocyte development,  
248-49
- Mesocricetus auratus*  
in gonadal regression, 75
- Metabolic blockers  
and platelet nucleotide meta-  
bolism, 680
- Metabolic cooperation  
transmission of  
and controls of gap junction  
functions, 284
- Metabolic homeostasis  
and insulin receptor  
structure and function, 357
- Metabolic interactions  
and junctional physiology,  
339-41
- Metabolic pool nucleotides  
soluble fraction  
and platelet nucleotide  
metabolism, 682
- Metabolic reutilization  
and lung surfactant recycling,  
797
- Metabolic substrates  
in renal mitochondria  
conclusion, 164  
introduction, 143  
mitochondrial transport sys-  
tems, 144-55  
role of, 155-64  
transport by proximal nephron  
amino acid transport, 109-  
13  
glucose transport, 104-9  
introduction, 103-4  
organic solute transport,  
115-19
- Metabolic substrates and trans-  
port  
cellular energy production  
interactions among, 97-99  
introduction, 85-86  
methods used to study, 86-  
88  
outline of the main path-  
ways, 88-91  
support of cellular function,  
91-97
- Metabolism  
and direct actions of GH, 491
- Metabolite compartmentation  
and pH changes  
in kidney mitochondrial  
transport, 162-63
- Methyl succinate  
and carboxylic acid transport,  
133-34
- Methylated lysine  
and RBC anion transport, 527
- Michaelis-Menten behavior  
in  $\text{Na}^+$ - $\text{H}^+$  exchange, 552
- Microdissected tubular segments  
and metabolic substrates and  
transport, 88
- Microfilaments  
and gastric mucosal re-  
epithelialization, 225-26
- Microsequencing  
and gap junction protein, 266
- Microsomal protein  
as contaminant of isolated  
lamellar bodies, 791
- Microtubule polymerization  
and intracellular transport of  
insulin, 391-92
- Microtubules  
and gastric mucosa re-  
epithelialization, 225-26
- Microvillus membranes (MVM)  
and ontogeny of intestinal en-  
zymes, 241

- Mineralocorticoid replacement and ontogeny of intestinal enzymes, 237
- Mitchell hypotheses and mitochondrial transport systems, 144-45
- Mitochondria and cytosol metabolic transport, 88
- Mitochondrial activity in cardiac cells regulation of electron-transfer, 648-53 introduction, 645 in vivo control of, 653-59 mitochondrial creatine kinase, 659-60 mitochondrial structure, 646-48 summary, 660
- Mitochondrial creatine kinase adenine nucleotide control of respiration, 709-15 aspects of integration of high-energy phosphate metabolism, 719-21 and cardiac mitochondrial function, 659-60 introduction, 707-9 role of mitochondrial creatine kinase, 715-19 summary, 721-22
- Mitochondrial exchange sodium-calcium in plasma membrane vesicles, 562
- Mitochondrial metabolite transporters kidney figure, 146
- Mitochondrial oxidative phosphorylation kinetics of and availability of ADP, 709
- Mitochondrial pyruvate dehydrogenase and insulin mediators, 410
- Mitochondrial respiration control of by oxygen, 653-54 in vivo control of cardiac function, 653
- Mitochondrial transport systems and the kidney, 144-55 physiological significance of in the kidney, 150-55
- Mitosis chemically induced inhibition of and enterocyte development, 256
- Mitotic proliferation regeneration by in gastric mucosa, 217
- Mixed oscillator and heartbeat, 36-38
- Modulatory inputs and oscillatory neural networks, 43-44
- Molecular mechanisms and calcium transport, 590
- Molecular signals transfer of and junctional physiology, 341
- Monensin and Type I IGF receptors, 435
- Mono-amine oxidase and cardiac mitochondrial function, 647
- Monoamines and inhibition of SCN activity, 58
- Monocarboxylates and RBC anion transport, 521
- Monocarboxylic acids transport of, 134-38 see also Carboxylic acids
- Monoclonal antibodies and growth hormone receptors, 477 and pulmonary surfactant, 778
- Monoclonal antireceptor antibodies and IGF receptors, 434
- Monosaccharides and insulin receptors, 362
- Monosynapticity and network oscillators, 35
- Monovalent acids and Na-cotransport, 136
- Morphology of the small intestine, 231-32
- Mortality from Respiratory distress syndrome, 812-13
- Motility and gastric development, 200
- Motor activity and circadian rhythms figure, 53
- Multioscillatory systems see Circadian neural rhythms
- Multiple insulin mediators evidence for, 411-14
- Multiple-unit activity (MUA) and circadian rhythms figure, 53
- Mustela furo* and photoperiodic control system, 75
- Mustelo putorius furo* endogenous circannual cycle, 71
- Mutarose and glucose transporters, 511
- Myo-inositol availability of and surfactant lipid synthesis, 770-71
- Myocardial adenine nucleotide translocation evidence supporting, 606
- Myocardial function and diminished ATP levels, 733-37
- Myocardial nucleotide transport adenine nucleotide uptake, 606-7 introduction, 605-6 nucleotide-derived nucleotide uptake, 608-11 nucleotide release, 611-13 summary, 613
- Myocardium see Mitochondrial activity in cardiac cells
- Myofilament activation and calcium-binding affinity, 586
- N
- Na-cotransport systems and carboxylic acids transport, 127, 135
- Na efflux uncoupled and the sodium pump, 538
- Na<sup>+</sup>-H<sup>+</sup> exchanger kinetic properties of plasma membrane interaction with external protons, 552-54 interaction with internal protons, 554-55 introduction, 545-46 kinetic models, 549-52 physiological implications, 555-57 stoichiometry, 546-47 substrate specificity, 547-49 summary, 557
- Na:Na exchange and ATP hydrolysis sodium pump, 539
- NAP-taurine and RBC anion transport, 522
- Natural selection and annual rhythms, 69
- Navanax* and gap junction functions, 282
- NEM treatment and sodium pump, 539
- Neonatal development and differentiation of enterocytes, 249-50
- Nerve cells

- with excitability characteristics and neural pacemakers, 17
- Nerve-cell membranes and neural pacemakers, 20-21
- Neural pacemakers and rhythmicity
  - factors regulating steady pacemaker current, 20-24
  - introduction, 17-20
- Neural tissue
  - within the SCN region in vitro studies, 53
- Neuraminidase and ontogeny of intestinal enzymes, 239
- Neurochemicals
  - in the SCN region mammals studies, 57
- Neuromodulation and cardiovascular nucleotide functions, 669
- Neurons
  - determination of synaptic relationships between, 32
  - in the oscillating neural network
    - identification of, 32
- Neurotransmission
  - pathological/therapeutic implications
    - in cardiovascular nucleotide function, 671-72
- Neurotransmitters
  - and gap junction functions, 296-97
  - and neural pacemakers, 23
- Neutral amino acids and metabolic substrate transport, 109-10
- Newborn and hypergastrinemia, 203
- Nexus
  - see Gap junctions, chemistry of
- Nicotinamide-adenine dinucleotide (NAD)
  - during ischemia and cellular damage, 732
- Niflumic acid and RBC anion transport, 522
- Nigericin and kidney mitochondrial transport, 147
- Nitrobenzylthioinosine (NBTT) and nucleotide metabolism, 619
- N-lauroylsarcosinate and gap junctional communication, 306
- Nonionic detergents and calcium transport, 575
- Nonphosphorylated enzyme and titration of the calcium sites, 582
- Nonskeletal tissue cell proliferation in effects of GH on, 489-90
- Norepinephrine and cardiovascular nucleotide functions, 667 and junctional physiology, 345
- Nucleic acid sequences and colonic cell maturation, 191
- Nucleic acids and radiolabeled hypoxanthine and junctional physiology, 339
- Nucleoside triphosphatase and cardiovascular nucleotide functions, 670
- Nucleotide analysis and ATP in skeletal muscles, 611
- Nucleotide-derived nucleoside uptake
  - evidence supporting, 608-11
- Nucleotide formation and degradation
  - platelet nucleotide metabolism, 685
- Nucleotide metabolism
  - by endothelium
    - adenosine uptake, 618-19
    - extracellular nucleotide catabolism, 622-23
    - conclusions, 624
    - intracellular adenosine metabolism, 619-20
    - intracellular nucleotide catabolism, 620-21
    - introduction, 617-18
    - stimulation of nucleotide release, 623-24
- Nucleotide occupancy and calcium transport, 590
- Nucleotide release and chromaffin tissue studies, 611
  - stimulation of
    - from endothelium, 623-24
- Nucleotide synthesis and free adenosine
  - in nucleotide transport, 611
- Nucleotide transport
  - see Myocardial nucleotide transport
- Nucleotides
  - purine
    - see Purine salvage
  - unimodal distribution of
    - in junctional physiology, 340
- Nucleotides and cellular damage in myocardial ischemia
  - adenine nucleotide degradation, 737-43
  - introduction, 727-29
  - myocardial function, 733-37
  - pathways of adenine nucleotide degradation, 729-33
  - summary, 743
- Nucleotides in heart and blood vessels
  - extracellular functions of endothelial purine regulation, 670-71
  - extracellular purine levels, 665-66
  - modes of action of purines, 667-69
  - pathophysiology, 671-72
- Nutrition and insulin-like growth factors, 447
- Nystatin and metabolic support, 94
- O
- Octanoate and oxidation of fatty acids, 95
- Oleate and metabolic substrates and transport, 98
- Oligomerization
  - ATPase chain and calcium transport, 576-77
- Oligosaccharide and insulin receptors, 362
- Oncogene theory and models of cell growth in cancer, 350
- Oncogenes
  - in human tumor cells, 191-92
- Oncopeltus
  - gap junctions in development, 326
- Ontogeny of intestinal enzymes
  - embryology of the small intestine, 231-32
  - enzymes declining in activity/postnatal period, 233
  - enzymes increasing in activity/postnatal period, 233-34
  - introduction, 231
  - molecular mechanisms, 241
  - regulation of enzymic changes, 234-41
- Oocyte gap junctions
  - development, 321-23
- Optic nerve stimulation and acetylcholine, 58

- Organic ions  
secretion of  
in metabolic transport, 113-15
- Organic solute transport  
adaptive changes in, 118-19  
effect of  
in cell volume, 117-18  
and metabolic substrate transport, 104
- Organic tracers  
and junctional permeability, 327
- Ornithine decarboxylase activity  
and insulin-like growth factors, 462
- Oscillators  
higher order  
and neural networks, 42-43
- Oscillatory networks  
types of, 30-32
- Oscillatory neural networks  
cellular and synaptic properties of, 40-42  
control of, 42-44  
examples of, 32-33  
introduction, 29-30  
leech heartbeat, 36-38  
lobster cardiac ganglion, 33-34  
lobster pyloric system, 38-40  
summary, 44  
types of, 30-32
- Osmium  
and ultrastructure of surfactant, 754
- Osmotic gradients  
large  
after reperfusion, 742
- Ovis aries*  
endocrine investigations in, 76
- Ovulation  
LH surge preceding  
and junctional physiology, 343
- Oxidative metabolism  
compartmentalization of  
energy metabolism, 632
- Oxidative phosphorylation  
and adenine nucleotide translocase  
in cardiac function, 655  
and energy metabolism, 630  
and metabolic substrates, 143  
and mitochondrial creatine kinase, 721
- Oxygen consumption  
creatine stimulated  
in muscle, 708  
and energy metabolism, 634  
in metabolic substrates, 87
- Oxygen poisoning  
and ultrastructure of surfactant, 759
- Oxynticopeptic cells  
and gastric development, 218
- P**
- Pacemaker current  
steady  
factors regulating, 20-24
- Pacemakers  
see Circadian neural rhythms
- PAH secretory pathway  
and metabolic substrate transport, 114
- Palmitic acid  
and lung surfactant recycling, 798
- Palmitoyl-carnitine  
and cardiac mitochondrial function, 651
- Palmitoyl-lysophosphatidylcholine (lysoPC)  
conversion of into DPPC, 768
- Pancreas  
see Insulin receptor, structure and function
- Pancreatic glucagon  
and ontogeny of intestinal enzymes, 240
- Papain  
and RBC anion transport, 525
- Parenchyma  
and lung lipids, 803
- Passer domesticus*  
photoperiodic species  
nonmigratory, 74
- Passive diffusion  
and chemistry of gap junctions, 263
- Passive fluxes  
and sodium pump, 540
- Patch conductance  
direct measurement of  
in gap junction function, 283
- Patella*  
gap junctions in development, 324
- Patent channels  
in permeable junctions  
junctional physiology, 338
- PC/sphingomyelin  
disaturated  
and lung lipids, 813
- PDH enzyme activation  
and cardiac mitochondrial function, 648-49
- Pentagastrin  
and gastric development, 201
- Pentagastrin-stimulated acid secretion  
and gastric development, 202
- Pepsin digestion  
and membrane domain  
in RBC anion transport, 526
- Pepsinogen  
and gastric development, 199, 204-05
- Peptide hormones  
and ligand internalization, 395  
see also Insulin receptor, structure and function
- Peptide map  
and heart gap junctions, 310  
and identification of gap junction proteins, 266
- Peptide mapping  
experiments  
and insulin receptors, 363  
and trypsinization of gap junctions, 270
- Peptide units  
and apolipoproteins of pulmonary surfactant, 777
- Peptides  
and digestive function of enterocytes, 250-53
- Perceptual/pattern information  
and circadian rhythms, 55
- Perfusate  
and substrate delivery during hypoxia, 727
- Pericyte activity  
and bidirectional signal transfer  
junctional physiology, 343
- Peristaltic behavior  
and oscillatory neural networks, 38
- Permeability  
of gap junctions, 338
- Permeability control  
and chemistry of gap junctions, 271
- Permeable junctions  
hormone effects on  
and junctional physiology, 344  
physiological roles of  
conclusion, 350  
general concepts, 338-39  
introduction, 337-38  
selected functional examples, 339-50
- Peromyscus leucopus*  
seasonal recrudescence of the gonads, 71
- pH  
and dissociation of IGF  
from binding complex, 448  
gating by  
in gap junction function, 284  
reducing external  
in  $\text{Na}^+\text{-H}^+$  exchange, 552

- pH dependence  
and RBC anion transport, 522
- pH sensitivity  
reduction of  
in gap junction function,  
290
- Pharmacology of gap junctions  
conclusions, 297  
gating of gap junction channels, 284-92  
introduction, 281-84  
pharmacology of gap junction channels, 292-97
- Phenylglyoxal-modified arginine  
and RBC anion transport, 529
- Phloretin  
and glucose transport, 104-9,  
511
- Phorbol diesters  
and insulin receptors, 371
- Phorbol esters  
and hepatectomy  
in chemistry of gap junctions, 268  
and insulin actions, 372  
and insulin mediators, 430  
and insulin receptor autophosphorylation, 374  
and metabolic cooperativity  
in gap junction functions,  
295
- Phosphagen  
breakdown of preformed  
and energy metabolism, 630
- Phosphate  
and bidimensional crystalline arrays  
of ATPase chains, 576
- Phosphate moieties  
and extracellular nucleotide catabolism, 622
- Phosphate reabsorption  
and fatty acids  
in metabolic transport, 98
- Phosphate transition site  
and vanadate  
in calcium transport, 591
- Phosphate uptake  
into cultured myocytes  
figure, 607
- Phosphatidic acid  
biosynthesis of  
and acylation of DHAP,  
767  
and sodium-calcium exchange,  
567
- Phosphatidyl choline molecules  
in aqueous lamellar system  
figure, 754
- Phosphatidylcholine (PC)  
decreased total  
and developmental aspects  
of lung lipids, 803
- surfactant  
synthesis de novo, 766
- Phosphatidylcholine synthesis  
lamellar bodies contributing  
to, 768-69  
and lung maturation, 806
- Phosphatidylglycerol  
synthesis of  
in lung microsomes, 770
- Phosphatidylinositol  
synthesis of  
in lung microsomes, 770
- Phosphocreatine  
and free creatine  
in energy metabolism, 631  
and the resting heart, 707
- Phosphodiesterase  
cAMP  
and insulin mediators, 406
- Phosphoenolpyruvate carboxykinase reaction  
and cardiac mitochondrial function, 655
- Phosphoenzyme  
and calcium binding, 581  
and hydrolysis  
in calcium transport, 590  
and sodium pump, 536
- Phospholipase A<sub>2</sub>  
and cardiac mitochondrial function, 647  
inhibitors  
and surfactant lipid synthesis, 768
- Phospholipase activation  
and cellular damage, 739-40
- Phospholipase C  
and sodium-calcium exchange,  
567
- Phospholipases  
and interaction of the Na-Ca exchanger, 566-67
- Phospholipid exchange proteins  
and lung surfactant recycling,  
790-91
- Phospholipid phosphorus  
and pulmonary surfactant, 784
- Phospholipids  
and pituitary growth hormone receptors, 474  
see also Developmental aspects of lung lipids
- Phosphopeptides  
and liquid chromatography,  
373
- Phosphoribosylpyrophosphate (PRPP)  
and gap junctional physiology,  
340
- Phosphoryl transfer reaction  
example of  
figure, 584
- Phosphorylase kinase  
and antibody probes  
of gap junctions, 312
- Phosphorylated crossbridge  
rate of cycling  
and energy metabolism, 638
- Phosphorylation  
of IGF receptors, 429-31  
Na requirement for, 538  
protecting adenosine from metabolism, 610
- Phosphorylation potentials  
and respiratory rates  
and mitochondrial creatine kinase, 712
- Phosphorylation reaction  
of the enzyme with P<sub>i</sub>  
and calcium transport, 583
- Photoc information  
reaching the SCN  
studies, 55
- Photoperiodic control systems  
and annual rhythms, 70-76
- Photoperiodism  
and annual rhythms, 65
- Phylloscopus trochilus*  
and annual rhythms, 72
- Pinocytosis  
and lethal ischemic injury,  
736
- Pituitary contaminant  
and metabolic effects of GH,  
491
- Pituitary extracts  
and growth hormone receptors  
two-chain forms, 473
- Pituitary growth hormone  
action of on target cells  
development of GH independence, 484  
direct effects on cell proliferation, 489-90  
direct effects of GH, 486-87  
early cellular events, 493-94  
effect of GH on cell differentiation, 490-91  
GH stimulates postnatal growth, 485  
introduction, 483  
in vitro effects of GH, 487-88  
metabolic effects of GH,  
491-93  
site of action of GH, 488-89  
somatomedin hypothesis of GH action, 485-86  
summary, 494-95  
nature and regulation of receptors for  
biochemical characterization, 473-76

- characterization of receptor function, 470-72  
 introduction, 469-70  
 monoclonal antibodies, 477-78  
 multiple GH receptors, 476  
 receptors for different forms, 472-73  
 summary, 478  
 Placental insulin receptor  
   physical characteristics  
     and IGF receptors, 435  
 Plasma choline concentrations  
   and fetal lung development, 808  
 Plasma glucose concentration  
   and exocytosis  
     in insulin-like growth factors, 446  
 Plasma membrane  
   and  $\text{Na}^+$ - $\text{H}^+$  exchanger, 557  
   and sensitivity to detergents, 264-65  
   upregulation of type II IGF receptors, 439  
   see also  $\text{Na}^+$ - $\text{H}^+$  exchanger  
 Plasma membrane localization  
   and vesicular  $\text{Na}$ - $\text{Ca}$  exchange activity, 562  
 Plasma membrane systems  
   generation of insulin mediator from, 408  
 Plasma peptides  
   GH dependent  
   see Somatomedins  
 Plasma somatomedin activity  
   and stimulatory effects of GH, 486  
 Plateau potentials  
   and oscillatory neural networks, 41  
 Platelet aggregation  
   pathophysiologic/therapeutic implications  
     in cardiovascular nucleotide function, 671  
 Platelet nucleotide metabolism  
   concluding remarks, 687-88  
   metabolic pool nucleotides, 682-85  
   nucleotide formation and degradation, 685-87  
   platelets, 677-80  
   storage pool nucleotides, 680-82  
 Pneumocytes  
   in utero  
   and Respiratory distress syndrome, 804  
*Poephila guttata castanotis*  
   and annual rhythms, 76  
 Polyacrylamide gel electrophoresis  
   alveolar proteinosis  
     figure, 781  
   Polyamine production  
     and ontogeny of intestinal enzymes, 232  
   Polycarboxylic acids  
     see Carboxylic acids  
   Polylisines  
     and nucleotide metabolism, 623  
   Polypeptide hormones  
     see Insulin-like growth factors  
   Polypeptide precursor  
     and insulin receptors, 375  
   Polypeptides  
     gap junction  
       in communication-defective cell lines, 314  
       and glucose transporter, 506  
        $\beta$  subunit  
         and insulin receptors, 363  
   Polyphosphoinositides  
     and sodium-calcium exchange, 567  
   Polyvalent anions  
     and kidney mitochondrial transport, 145  
   Postinhibitory rebound  
     and bursting pacemaker potential mechanisms, 40  
     and neural networks, 41  
   Postischemic acute renal failure  
     and cardiovascular nucleotide function, 672  
   Postmicrosomal supernatant  
     and phospholipid exchange proteins (PLEPs), 790  
   Postnatal development  
     and differentiating enterocytes, 248  
     enzymes that increase in activity during, 233  
     and ontogeny of intestinal enzymes, 231-33  
   Postnatal growth  
     and direct actions of GH, 485  
   Postnatal somatic growth  
     and direct actions of GH, 494  
   Postsynaptic hyperpolarization  
     and gap junction functions, 290  
   Potassium channels  
     and neural pacemakers, 19  
   Potassium conductance  
     cAMP suppressing  
       and neural pacemakers, 22  
   Potassium-induced contractures  
     and energy metabolism, 635  
   Predictive information  
     and annual rhythms, 65  
   Premature newborns  
     and Respiratory distress syndrome, 803  
   Progesterone  
     and fetal lung development, 808  
   Prolactin  
     in ligand internalization, 385  
     see also Putative prolactin  
   Prolactin (PRL) receptors  
     and radioreceptor assay for growth hormone, 469  
   Pronase  
     and RBC anion transport, 525  
     and sodium-calcium exchange, 568  
   Prostacyclin  
     and platelet aggregation  
       in cardiovascular nucleotide functions, 671  
   Prostaglandins  
     and gap junctional physiology, 345  
     and gastric mucosa, 226-27  
     and platelet nucleotide metabolism, 677  
     see also Carbonic anhydrase  
   Protease  
     effects of  
       on gap junction protein, 269-70  
     isolating  
       and gap junctions, 265-66  
     neutral  
       and release of endothelial nucleotides, 625  
   Protease inhibitors  
     and insulin mediators, 414  
   Protein A  
     and growth hormone receptors, 477  
   Protein chemistry  
     of insulin receptors, 360-68  
   Protein kinase  
     and direct action of GH, 494  
   Protein phosphorylation  
     and platelet nucleotide metabolism, 677  
     tyrosine-specific  
       and growth hormone receptors, 472  
   Protein reagents  
     group-specific  
       and gap junction function, 293  
   Protein synthesis  
     and gastrointestinal cell growth, 179  
     and insulin-like growth factors, 450  
   Protein synthesis inhibitors  
     and gap junction polypeptides, 314  
   Protein-wasting syndromes  
     as pathologic metabolic state  
     causal factors, 650

- Proteins  
   in mature animals, 777  
 Proteoliposomes  
   and sodium-calcium exchange, 568  
 Proteolysis  
   and gap junction chemistry, 270  
   in situ  
     and RBC anion transport, 524-25  
     and liver gap junction polypeptides, 308-9  
   native structure  
     and glucose transporter, 506  
   sequential B subunit  
     and insulin receptors, 364  
 Proteolytic enzymes  
   and insulin-like effects of trypsin, 406-7  
 Proton dissociation constants  
   and mechanisms of calcium transport, 591  
 Protonophore  
   and basic amino acids  
     in metabolic substrate transport, 111  
 Protons  
   interaction with external  
     in  $\text{Na}^+\text{-H}^+$  exchange, 552  
   interaction with internal  
     and  $\text{Na}^+\text{-H}^+$  exchange, 554  
 Proximal nephron  
   relation of organic solute transport to, 115-19  
 Proximal tubular transport  
   see Metabolic substrates and transport  
 Pulmonary intracellular adenosine metabolism  
   and ATP, 620  
 Pulmonary surfactant  
   see Apolipoproteins of pulmonary surfactant  
   see Developmental aspects of lung lipids  
 Pulmonary surfactant system  
   of the developing lung, 765  
 Purine nucleoside transport  
   inhibition of  
     and myocardial hypoxia, 731  
 Purine salvage  
   pathways in myocardium  
     introduction, 691-92  
     metabolism of products of salvage, 699-701  
     production of substrates of salvage, 698-99  
   salvage enzymes and metabolism, 692-98  
 Purinergic neurotransmission  
   and cardiovascular nucleotide function, 669-70  
 Purines  
   modes of action of cardiovascular nucleotide functions, 667-69  
 Purinoceptor-mediated vasoregulation  
   and nucleotide metabolism, 617  
 Putative prolactin peptide mediator  
   and insulin mediators, 416  
 Pyloric oscillatory mechanisms  
   and neural networks, 39  
 Pyloroplasty  
   and gastrointestinal cell growth, 178  
 Pyridoxal phosphate  
   and RBC anion transport, 527  
 Pyrimidopyrimidines  
   and platelet nucleotide metabolism, 686  
 Pyruvate  
   and carboxylic acid transport, 137  
   decarboxylation of  
     and thiamin, 2  
   and metabolic substrates, 89  
   and RBC anion transport, 520  
 Pyruvate dehydrogenase  
   and insulin receptors, 357  
 Pyruvate dehydrogenase complex  
   regulatory role of  
     in cardiac mitochondrial function, 648  
 Pyruvate dehydrogenase inhibitory mediator  
   and insulin, 414  
 Pyruvate transporter  
   control strength of  
     in respiration in isolated mitochondria, 153  
 R  
 Radiolabeled lectins  
   and antibody probes for gap junctions, 307  
 Radiolabeled metabolite transfer  
   and study of gap junctional communication, 305  
 Radiolabeled substances  
   transmission of  
     and gap junction functions, 284  
 RAMP depolarization  
   and oscillatory neural networks, 35  
 Rate-limiting steps  
   and surfactant lipid synthesis, 769-70  
 Reaction cycles  
   permitting uncoupled fluxes  
     and  $\text{Na}^+\text{-H}^+$  exchanger, 550  
 Reaction-diffusion models  
   and morphogens  
     in gap junction development, 321  
 Reaction mechanisms  
   analysis of  
     and calcium transport, 594  
 Reactive hyperemia  
   of reperfusion  
     killing viable myocytes, 742  
 Receptor disulfides  
   and insulin receptors, 365  
 Receptor function  
   pituitary GH  
     characterization of, 470  
 Receptor internalization  
   and recycling  
     ligand internalization, 393-94  
 Receptor phosphorylation  
   and insulin mediators, 410  
 Receptor recycling  
   and protein chemistry of insulin, 360-68  
 Receptor structure  
   and subunit stoichiometry  
     insulin receptors, 364  
 Reciprocal inhibition  
   and oscillatory neural networks, 31  
 Reciprocal inhibitory circuits  
   and neuronal oscillators, 44  
 Reciprocal inhibitory synaptic connections  
   PD-to-LP cell pairs, 40  
 Reconstitution  
   and glucose transporters, 503-8  
 Recovery metabolism  
   and high-energy phosphate utilization  
     relationship between, 629  
 Recycling  
   and receptor internalization  
     and uptake of ligands, 393-94  
 Red blood cell anion transport  
   kinetics and mechanisms of introduction, 517  
   kinetics of band 3-catalyzed anion exchange, 520-23  
   possible mechanisms of anion exchange, 528-29  
   role of  $\text{Cl-HCO}_3$  exchange, 519-20  
   structure of band 3 protein, 523-28  
 Regulation



and gastric development, 208-11  
 Remodeling mechanisms and surfactant lipid synthesis, 767  
 Renal metabolism and gluconeogenesis, 155-64  
 Renal microvillus membrane vesicles and  $\text{Na}^+$ - $\text{H}^+$  exchanger, 549  
 Reperfused contracting myocardium with a low ATP and cellular damage, 734  
 Reperfusion effects of on ischemic myocardium, 741  
 Repetitive firing properties and neural networks, 41  
 Reproduction see Annual rhythms  
 Respiratory control see Mitochondrial creatine kinase  
 Respiratory distress syndrome and lung lipids developmental aspects, 803  
 Respiratory physiology prewar and postwar, 4  
 Respiratory system and metabolic support, 94  
 Restitution electron micrograph of rat gastric mucosa figure, 222 implications of in gastric mucosa, 227-28 and inflammation, 218 in vivo and gastric mucosa, 222  
 Retardation and direct actions of GH, 484  
 Retinal inputs into the SCN importance of, 55  
 Retroviruses and junctional physiology, 348  
 Rhythmic neural signals and circadian rhythms, 60  
 RNA and gastrointestinal cell growth, 179 and insulin-like growth factors, 462  
 Rotenone and the renal cortex, 163  
 Rous sarcoma virus transforming kinase of and insulin receptors, 369

S

S-adenosylhomocysteine (SAH) hydrolase and production of adenosine, 698  
 Salicylate poisoning and RBC anion transport, 520  
 Saline perfusion and gastric development, 200  
 Salt and water absorption in organic solute transport, 116-17  
 Sarcoma virus Moloney murine and junctional physiology, 348  
 Sarcoplasmic reticulum Ca pump from, 540 experimentation with and calcium transport, 593  
 Sarcoplasmic reticulum (SR) membrane and calcium transport, 573 and mitochondrial creatine kinase, 719  
 Sarcoplasmic reticulum ATPase membrane assembly and structure in calcium transport, 574  
 Scatchard analysis for determining binding capacity, 429  
*Schistocerca* and gap junction development, 329  
 SDS-electrophoresis and growth hormone receptors, 474  
 SDS gel electrophoresis and major intrinsic protein (MIP) and chemistry of gap junctions, 272  
 SDS polyacrylamide gel electrophoresis and purification of junction proteins, 267  
 Secretion mechanisms of and lung surfactant recycling, 794  
 Secretory cells with excitability characteristics and neural pacemakers, 17  
 Self-inhibition and RBC anion transport, 522  
 Sensory feedback and neuronal oscillators, 44  
 Septate axon junctions earthworm and charge selectivity, 274

Sequential degradation and apolipoproteins of pulmonary surfactant, 782-83  
 Serine phosphorylation and insulin receptors, 368  
 Serine/threonine phosphorylation and phorbol esters, 372  
 Serotonin and platelet nucleotide metabolism, 681  
 Serum-binding proteins and insulin-like growth factors, 464  
 Serum inositol and surfactant lipid synthesis, 771  
 Sex hormones and annual rhythms, 66  
 Signal recognition particles and ATPase chain in calcium transport, 574  
 Signal transduction and development of gap junctions, 319  
 Siliac acid residues and insulin receptors, 363  
 Skeletal growth and direct actions of GH, 494  
 Skeletal muscle and extracellular ATP in nucleotide transport, 607  
 Skin temperature and history of physiology, 4  
 Small intestine diseases of, 181 and gastrointestinal cell growth, 180-81  
 Smooth muscle energetics goal of studies on, 633  
 Sodium interaction of with succinate carrier, 131-33  
 Sodium-calcium exchange in plasma membrane vesicles calcium-calcium exchange, 566 general properties of, 563-66 introduction, 561 isolation and reconstitution, 568 methodological considerations, 562 other tissues, 568-69 perspectives, 569 pharmacology, 568 plasma membrane localization, 562 regulation of, 566-68  
 Sodium pump ion movements through

- Albers-Post model, 535-36  
 conformational transitions, 541-42  
 introduction, 535  
 occluded cations, 541-42
- Sodium reabsorption  
 and gluconeogenesis  
 in renal metabolism, 156
- Sodium transport  
 and renal metabolism, 156
- Somatic growth  
 results of growth hormone (GH) action on, 483
- Somatomedin hypothesis  
 of GH action, 485-86  
 and growth hormones  
 liver, 456
- Somatostadins  
 and insulin-like growth factors, 443  
 and pituitary growth hormones, 483  
 and tonic inhibition on gastrin release, 207
- Sonication  
 and glucose transporter, 504
- Soybean trypsin inhibitor  
 and insulin mediators, 407
- Spectrophotometric techniques  
 and sodium-calcium exchange, 564-65
- Spermophilus lateralis*  
 vertebrate species studies, 71
- SR ATPase  
 catalytic and transport cycle of  
 figure, 588  
 transport cycle of  
 figure, 580
- Staphylococcus aureus*  
 and insulin receptors, 363
- Steady-state kinetic behavior  
 and calcium transport, 595
- Steroid  
 and ontogeny of intestinal enzymes, 237
- Stilbene disulfonate (DIDS)  
 and metabolic transport, 113
- Stilbenedisulfonate binding  
 stoichiometry of  
 and RBC anion transport, 523
- Stilbenedisulfonate derivatives  
 and RBC anion transport, 521
- Stimulation  
 energy usage during  
 in energy metabolism, 640
- Stoichiometry  
 of catalytic sites  
 in calcium transport, 574  
 and kinetics  
 glucose transport in, 106-8  
 and  $\text{Na}^+\text{-H}^+$  exchanger, 546  
 and sodium-calcium exchange, 565
- subunit  
 and insulin receptor structure, 364
- Stomach  
 diseases of, 179  
 and gastrointestinal cell growth, 177  
 see also Gastric mucosa, re-epithelialization
- Stomatogastric ganglion  
 and oscillatory neural networks, 38
- Storage pool nucleotides  
 and platelet nucleotide metabolism, 680-82
- Streptozotocin (STZ)  
 and lung lipids, 815
- Stress  
 and glucose transporter, 508
- Sturnus vulgaris*  
 and annual rhythms, 73  
 and circannual cycles, 69
- Substrate infusion  
 and fetal lung development, 811
- Substrate metabolism  
 see Metabolic substrates and transport
- Substrate specificity  
 and  $\text{Na}^+\text{-H}^+$  exchanger, 547
- Succinate  
 kinetics of, 130-31
- Sucrase  
 and enterocyte development, 251  
 and ontogeny of intestinal enzymes, 234  
 precocious appearance of  
 and ontogeny of intestinal enzymes, 237
- Sucrose  
 and apolipoproteins  
 of pulmonary surfactant, 778
- Sulfate  
 probenecid-inhibitable trans-stimulation, 114
- Sulfation activity  
 and insulin-like growth factors, 443
- Suprachiasmatic nucleus  
 anatomy of, 54-56  
 and circadian neural rhythms, 50  
 intrinsic oscillations, 52-54  
 lesion studies, 50-52  
 neurochemistry, 56-59
- Surfactant apolipoproteins  
 metabolism of  
 lung, 785
- Surfactant lipid synthesis  
 in the adult lung  
 conclusions, 772  
 general comments, 766  
 introduction, 765  
 other lipids, 771  
 phosphatidylcholines, 766-70  
 phosphatidylglycerol, 770-71
- Surfactant lipids  
 see Intracellular processing  
 of surfactant lipids
- Surfactant phospholipids  
 ultrastructure of, 755
- Surfactant research  
 contribution of electron microscopy to, 760
- Survival  
 and evolutionary adaptations, 77
- Synapses  
 synaptic properties of  
 oscillatory network neurons, 40-44
- Synaptic inhibition  
 and oscillatory neural networks, 37
- T
- Target cells  
 see Ligand internalization
- Teaching  
 as an art, 5-6  
 and methods of learning, 2
- Temperature  
 dependence  
 and gating process, 292
- Testosterone  
 and glucose/amino acid uptake, 119
- Tetracycline  
 method  
 and direct actions of GH, 487
- Tetraethylammonium  
 and calcium concentration, 668
- Theophylline  
 and inhibition by ATP, 668
- Thermodynamic barriers  
 and mechanisms of calcium transport, 593
- Thermodynamics  
 and  $\text{Na}^+\text{-H}^+$  exchanger, 555
- Thermolysin  
 and RBC anion transport, 525
- Thiamin  
 and decarboxylation of pyruvate, 2
- Threonine phosphorylation  
 and insulin receptors, 368
- Thrombin degranulation  
 and ADP

- in platelet nucleotide metabolism, 682
- Thromboxanes
  - and platelet nucleotide metabolism, 677
- Thymidine
  - and growth hormone receptors, 471
  - and insulin-like growth factors, 448
- Thymidine incorporation
  - and DNA
    - in IGF receptors, 437
- Thymidine kinase activity
  - and DNA synthesis, 178
- Thyroid function
  - and insulin-like growth factors, 447
- Thyroid hormones
  - and gastric development, 209
  - secretion and metabolism of during pregnancy, 809
- Thyroxine
  - and fetal lung development, 810
  - and gastric development, 209
  - role of
    - and ontogeny of intestinal enzymes, 239-40
- Tissue culture
  - and gastrointestinal epithelial cells
    - colonic adenomas, 188-89
- Tissue differentiation
  - loss of gap junctions during, 328-30
- Tissue homeostasis
  - and permeable junctions
    - physiological roles of, 337
- TNP-nucleotide analogs
  - and ATP binding, 580
- Toxins
  - and LDL pathway, 383
- TPA treatment
  - and junctional physiology, 349
- Transduction
  - of high-energy phosphate breakdown
    - mechanism of, 629
- Trans epithelial transport
  - and oxidation of CO<sub>2</sub>, 85
- Transfer time intervals
  - and cellular growth
    - in junctional physiology, 348
- Transferrin receptor
  - and ligand internalization, 393
- Transforming genes
  - and human tumor cells, 191-92
- Transfunctional voltage
  - and gap junctions in development, 331
- Translocase
  - and exogenous nucleotides interacting with
    - ADP generation, 717
    - structure and localization of figure, 646
- Translocation
  - of cycling receptors to cell surface
    - and insulin, 432
    - and RBC anion transport, 522
- Trans membrane signaling
  - and ligand internalization, 395
- Transmission electron microscopy
  - and lung surfactant recycling, 791
- Transphosphorylation
  - as the function of creatine kinase, 708
- Transplantation
  - techniques
    - and gastrointestinal cell growth, 190
- Transport
  - importance of varying characteristics
    - along proximal nephron, 116
    - and pericyte activity, 343
    - see also Red blood cell anion transport
  - Transport activities
    - catalytic and transport cycle in calcium transport, 577
  - Transport modes
    - and substrate specificity
      - in Na<sup>+</sup>-H<sup>+</sup> exchange, 547
      - and the sodium pump, 536
  - Transport moiety
    - and cell shrinkage
      - in hypotonic media, 548
  - Transport systems
    - see Na<sup>+</sup>-H<sup>+</sup> exchanger
  - Transverse colostomy
    - and gastrointestinal cell growth, 183
- Trehalase
  - and ontogeny of intestinal enzymes, 234
- Triacylglycerols
  - and metabolic substrates and transport, 91
- Tricarboxylic acid anionic metabolites
  - and kidney mitochondrial transport, 148
- Trichloroacetic acids
  - and ADP-actin bond
    - in platelet nucleotide metabolism, 683
- Triglycerides
  - and metabolic substrates, 98
- Triiodothyronine (T<sub>3</sub>)
  - and insulin-like growth factors, 460
- Tritium efflux
  - and acetylcholine
    - in cardiovascular nucleotide functions, 671
- Triton X-100 extraction
  - and antibody probes
    - for gap junctions, 309
- Tritonia diomedea*
  - as network oscillator, 34-36
- Trypsin
  - and enterocyte development, 256
  - and gap junction chemistry, 269-70
  - and gap junctional communication, 306
  - and glucose transporters, 509
  - insulin-like effects of, 406
  - and insulin-like mediator production of, 414
- Trypsin hydrolysis
  - and liquid chromatography
    - in insulin receptor regulation, 373
- Tubular myelin
  - and apolipoproteins
    - of pulmonary surfactant, 778
  - high-power microscopy
    - figure, 758
  - and lamellar bodies
    - figure, 756
  - and ultrastructure of surfactant, 757-59
- Tubule suspensions
  - and metabolic substrates and transport, 87
- Tumors
  - and IGF levels, 454
  - and junctional physiology, 347
  - substances promoting
    - and gap junction function, 295
    - and junctional physiology, 349
- Type I IGF receptor
  - physical characterization of, 428
- Tyrosine kinase
  - autophosphorylation by
    - and IGF receptors, 426
  - insulin receptor
    - enzymology of 368-70
  - receptor-associated
    - regulation of, 373-75
- Tyrosine kinase activity
  - insulin receptor regulation, 375
  - intrinsic
    - and IGF receptors, 430

- Tyrosine phosphorylation  
and growth hormone receptors, 472  
and insulin receptor B, 375  
and type I IGF receptor, 430
- Tyrosol  
residue  
and carboxylic acid transport, 139
- U
- UDP galactose transferase  
and lung surfactant recycling, 793
- Ultrastructure of alveolar surfactant  
histological preservation and fluid lining of alveolar epithelium, 759-62  
introduction, 753  
Lamellar bodies, 753-56  
summary, 762  
tubular myelin, 757-59
- Uniform repetitive activity  
conductance models, 19
- V
- V<sub>s</sub> protease  
and treatment of lens junctions, 273
- Vagotomy  
and gastrointestinal cell growth, 178
- Valeraldehyde  
and gap junction function, 295
- Valinomycin  
and calcium dependency, 563  
and kidney mitochondrial transport, 147
- Vanadate  
bidimensional crystalline arrays  
in calcium transport, 576  
and phosphate transition state in calcium transport, 591
- Vanadate binding  
and destabilization effects in calcium transport, 592
- Vascular endothelium  
and nucleotide metabolism, 617
- Vascular perfusion  
rabbit lung fixed by figure, 758
- Vascular permeability  
and cationic proteins in endothelial nucleotide metabolism, 623
- Vasodilation  
and cardiac functional hyperemia, 666  
EDTA causing in nucleotide transport, 613
- Vertebrate neurons  
and neural pacemakers, 20
- Viruses  
and LDL pathway  
and uptake of insulin, 383
- Vitamins  
ancient history of, 2  
and gap junction functions, 296-97
- Voltage dependence  
and gap junction function, 287
- Voltage sensitivity  
reduction of in gap junction function, 290
- Volume regulatory response  
and cellular damage, 735
- W
- Water absorption  
and salt  
organic solute transport, 116-17
- Weaning  
and disaccharides, 234  
and gastric development, 208
- Wheat germ agglutinin  
and antibody probes  
for gap junctions, 307  
and insulin receptors, 369
- Work production  
energy usage during  
and energy metabolism, 639
- Wounds  
and insulin-like growth factors, 464
- X
- Xanthine (XAN) production  
and cytosolic 5' nucleotidase, 731
- Xanthine oxidase  
and antibodies against in purine salvage, 694  
reactions catalyzed by  
and purine salvage, 692
- Xenopus*  
and gap junction development, 329
- Z
- Zonotrichia leucophrys gambelii*  
and annual rhythms, 68, 73

